GASMACO WROTE THE HISTORY OF OIL GAS

MANY YEARS AGO The Gas Machinery Company entered the field of oil gas production and ever since has unceasingly maintained a policy of development and expansion. In the multiple phases of oil gas process and equipment we have always been in the forefront . . . the Leader. We have been The Pioneer in this ever-changing industry, where being first and staying first is indeed an achievement.

A few of the milestones, or yearmarks in the history of Oil Gas and The Gas Machinery Company:

1912 — Design and construction of low Btu Oil Gas Generating Equipment for the Pacific Coast.

1933 — Development of process and equipment for Hi-Btu Oil Gas with solid fuel heating. Contributed by members of the gas industry including W. E. Steinwedell of Gasmaco.

1942 — The Blain Process. Hi-Btu Oil Gas with oil heating in Single Generator and Twin Generator sets.

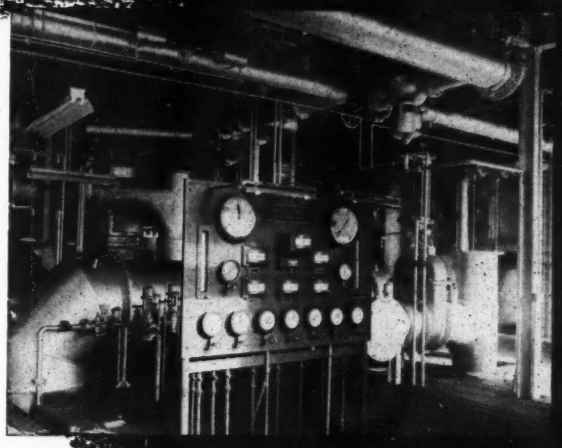
1947 — Four Shell Regenerative Oil Gas Apparatus for heavy oils. (Hall A.G.A. Process).

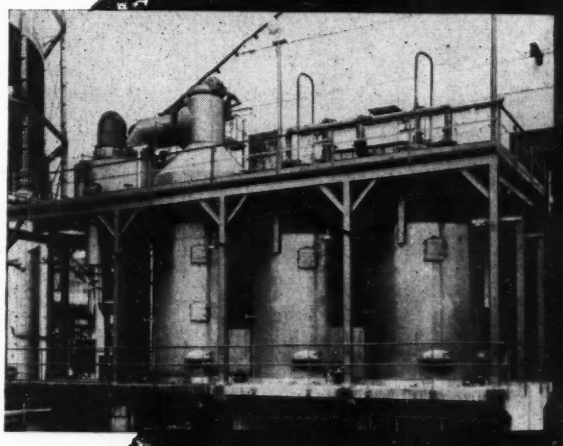
1948 — Two Shell Regenerative Oil Gas Set. The Inverted "U".

1949 — Back Blast modification of existing sets to accommodate heavy high carbon oils and improve efficiency.

1950 — Low cost conversion methods, adapting water gas plants to natural gas substitutes.

1951 — Development of new and improved auxiliary equipment for Tar Handling, Gas Washing, Oil Scrubbing, Light Oil Recovery and other problems peculiar to Hi-Btu Oil Gas.





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GAS

29th Year of Publication

OCTOBER 1953 • VOLUME XXIX • NUMBER 10

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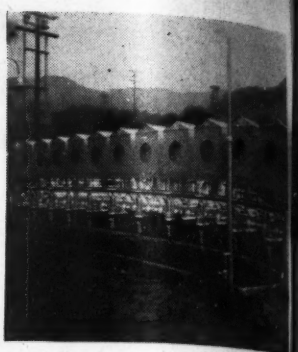

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ROCKWELL

to Share in Pride of Achievement

NEW PLANTS

ENLARGED WAREHOUSE FACILITIES

IMPROVED PRODUCTS

No manufacturer can prosper and grow without turning out good products. None can enjoy continuing success without making material contributions to the industries served.

Robert Louis Stevenson said, "I know what pleasure is, for I have done good work." And Elbert Hubbard, the sage of Aurora, once remarked that he felt sorry for a square peg in a round hole.

Well, here at Rockwell, we try our best to have square pegs in square holes. We take pride in the joy of achievement. We, too, know what pleasure is, for we have done good work through all the years we have been making meters, regulators and valves.

The fact that our growth pattern exceeds, percentage-wise, the overall growth of the gas business is cause for elation. We didn't acquire this volume by any magic formula. We gained it by paying meticulous care and attention to every order, seeing that the customer got what he wanted when he wanted it, together with the assurance that it was made of the best materials.

Being only human, we occasionally make mistakes. But when we make them, we pay for them. That's fair, isn't it?

Recently we have opened three new plants and expanded our warehouse and service facilities in several locations. (See following pages.) This is our way, through bettered service to thank those who made this expansion possible. It is our tangible expression of faith in the future of the gas business—and a confidence you can share in your own operations.

GAS Leads The Way To Better Living

The tremendous growth of the gas industry could not have been possible without efficient and attractive appliances to utilize this fuel. "Gas does its best"—for cooking, space heating, hot water and clothes drying—only because gas appliance manufacturers have built better performance and better values into their products. We at Rockwell salute our appliance manufacturing associates. We pledge our continued efforts and close cooperation in the furtherance of an industry it is our good fortune to serve.

ROCKWELL

ROCKWELL

Growing With the G

We have recently opened three new factories. These were established for the express purpose of improving our service and lessening distribution costs for customers in the areas they serve.

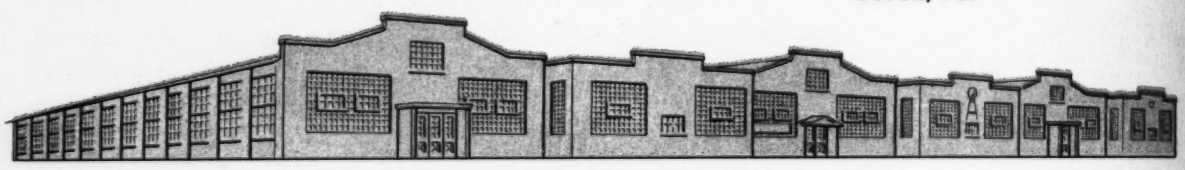
All new equipment has been installed in these factories. Older properties, too, have been enlarged and modernized.

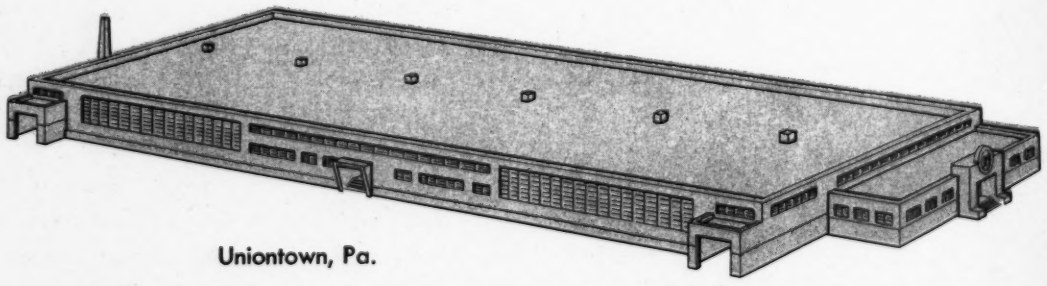
With our up-to-date machinery plus the latest in manufacturing techniques and methods we can now produce a greater volume of even better products.

NEW PLANTS

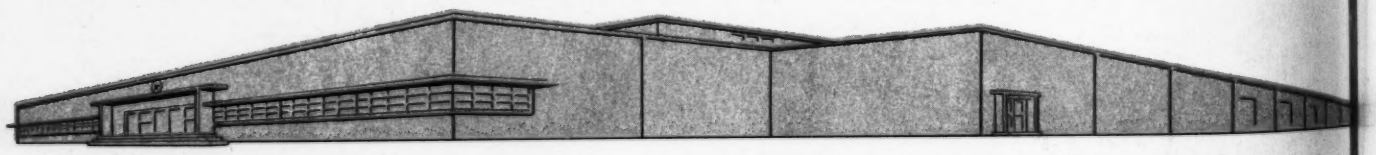
Today there are 17 Rockwell plants humming with activity. Geographically they spread from coast to coast. Now, more than ever before, you can "Rely on Rockwell" for the precision-built measurement and control equipment you need, when you need it.

DuBois, Pa.





Uniontown, Pa.

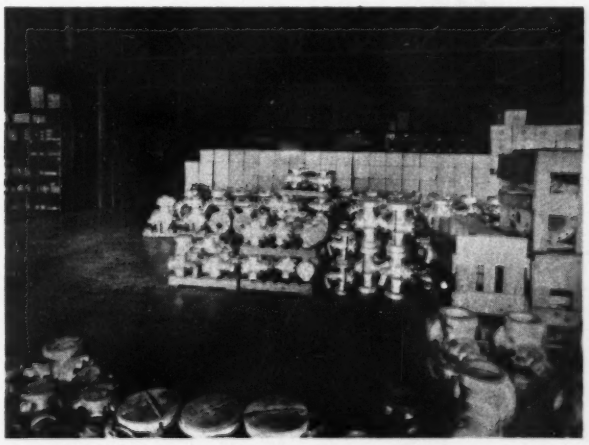


Sulphur Springs, Texas

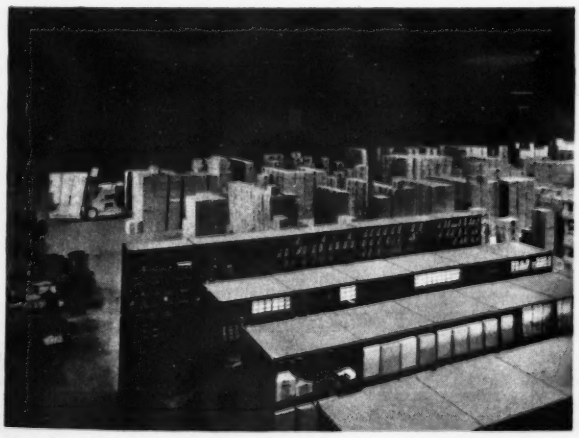
Growing Gas Business

NEW WAREHOUSES and Service Facilities

Our recently completed warehouse facilities in Kansas City, Atlanta, Oakland and Sulphur Springs are now providing superior service to all users of Rockwell products in these areas. For customer convenience we maintain here and at six other locations throughout the country complete warehouse stocks of Rockwell meters, regulators and Nordstrom valves. In many cases we can make overnight deliveries. Also, from well stocked bins and shelves we can furnish immediate service on repair parts orders. Further, most of our warehouses are equipped to do maintenance and repair work, thereby saving on freight to and from the factory. We invite equipment buyers to take full advantage of the "off-the-shelf" buying convenience and economy our extensive warehousing program makes possible.



Interior Views of New Rockwell Warehouses



Rockwell Warehouses are located at Atlanta, Boston, Chicago, Houston, Kansas City, Los Angeles, Oakland, Seattle, Sulphur Springs and Tulsa.

ROCKWELL

Better Products for You

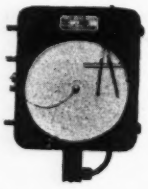
Here at Rockwell we are consistently seeking new ways to make better products, constantly adding to the Company's productive capacity, continually striving to increase our usefulness to the gas industry.

Aluminum Meters

Tin Meters

Cast Iron Meters

Pressed Steel Meters



Orifice Meters

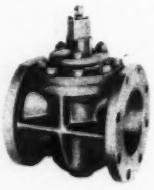
Service Regulators

Industrial Regulators

"1001" Regulators

Balanced Valve Regulators

Nordstrom Service Cock



Nordstrom Standard Valve

Nordstrom Hypreseal Valve

ROCKWELL MANUFACTURING COMPANY

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Thermally Thinking

SPOT NEWS AND COMMENT ON GAS INDUSTRY AFFAIRS

Highlighting the News

Altoona a "test city"

The first of the 10 "test cities" for the AGA-GAMA Gas Industry Development Program to be publicly identified is Altoona, Pa. Peoples Natural, Pittsburgh, the distributor, lifted the shroud of secrecy in an announcement late last month in which it was stated the company would "put natural gas under a figurative microscope during this one-year test to determine how gas service facilities, as well as gas appliance sales, can be improved and extended." First step is establishment of a gas service school, followed by a study of distribution facilities, increased promotional aids to dealers, and customer opinion surveys.

FPC permits substitution for "allowables" cutback

When the Kansas Corporation Commission ordered a cutback in Northern Natural production to conform to allowables, the company had to arrange for 50 MMcf per day from another source. FPC has conditionally approved a plan to boost deliveries from Phillips Petroleum, via El Paso Natural's Dumas (Texas) compressor station. Northern had previously been permitted (May 1) to take gas through the interconnection.

Export permit for TGT

Following issuance of a certificate to Tennessee Gas to export gas at the Canadian border to Niagara Gas Transmission Ltd. (see Pipeline News), FPC has voted TGT an export permit. President Eisenhower had previously signed an executive order delegating the commission this power. In its action, FPC made clear it considered it as a "ministerial act, pursuant to and having no substantive effect upon its order . . . nor upon the petition filed Sept. 9 for rehearing on that order by Trans-Canada Pipeline Ltd. . . ." Nelson Lee Smith again dissented, this time on the grounds that the permit should be held up pending action upon Trans-Canada's motion.

Better times ahead for Texas Eastern

A plan for settlement of its pending rate case, agreed to by intervenors and FPC's staff, has been submitted by Texas Eastern. The new rate would expand annual revenues by $4.6 million, topping off a $26 million increase effected last Dec. 1 on an interim rate and now made permanent. Furthermore, additional sales that would produce a gross of $9 million were involved. Annual volumes of more than 22 billion feet would be split among two Pittsburgh, two Philadelphia, one New Jersey and one Ohio utility, with Manufacturers of Pittsburgh getting the largest share—10,950 MMcf. President Hargrove is enthusiastic over earnings prospects under the plan.

Look to older homes for air conditioning market

Incoming GAMA President Sheldon Coleman thinks the modernization market is the most fertile ground for air conditioning sales. Forty million homes in the U. S. lack central heating or air conditioning, he said, and the average one can be modernized with air conditioning for the "price of a low-cost automobile."

No letdown, says Donnelly

The end of the war in Korea signals the start of a new war for appliance manufacturers — the war on obsolescense, says GAMA head James Donnelly. One-half the gas ranges in use are obsolete, as are millions of water heaters. Among newer appliances — clothes driers, incinerators, air conditioners—the pioneering stage is over and we're in the mass production era, he said.

An Eye on the Capital

Somebody goofed

The United Fuel Gas Co., a subsidiary of the Columbia Gas System, has petitioned the Federal Power Commission for a rehearing on its recent order which the FPC had stated would give the company a 6¼% rate of return, but, the company insists, actually would return it only 3.69%.

The issue resolves around a question of fact, the company states, insisting that the ultimate effect of the FPC order would be to reduce net income by almost $2.7 million during 1953.

Within two weeks of the time the order—generally hailed in natural gas circles—was released, there was general chagrin among officials of the Columbia Gas System. They began to look for the "nigger in the woodpile," and they say privately that they are convinced that FPC commissioners are not responsible, but that the commissioners have been misled by underlings who did not know what they were doing. It isn't going too far afield to guess that if the commissioners do find out they were misled, there will be some shake-ups in the FPC staff.

United Fuel Gas contends in its peti-

Thermally Thinking

tion for review that: (1) There was an error in reducing the rate base by $3.7 million; (2) the allowance for annual operating expenses was reduced erroneously by about $2 million; (3) the computation of income taxes was incorrect; (4) the depreciation rates prescribed by the order are without support; (5) the method of allocation of costs is arbitrary and unreasonable and injurious to the financial position of the company, and (6) the rate form used by the commission usurps the rights of management.

The application cites 18 specific points of contention between the company management and the FPC staff experts, and states that in only one of these did the order accept the management's conclusion.

Because of the petition, the FPC decided to hold up that part of its order which would reduce company revenues about $3 million, in conformity with its general opinion authorizing a basic increase of $10 million. The company has two rate increases on file with the commission, totaling $13 million, and has been collecting both under bond. Enforcement of the $10 million rate increase would require a net reduction of $3 million.

Rapid write-offs may be permanent

Sen. Homer E. Capehart (R.-Ind.), chairman of the Senate Committee on Banking and Currency, has urged, in a between-the-sessions statement, that the Congress take swift action on his bill, S. 2306, to make rapid tax amortization a part of the peacetime economy, and utilities generally are expected to rally 'round this viewpoint.

The bill is put forward as an "economic expansion" measure which, sponsors say, "would create a climate for continued high employment." The Office of Defense Mobilization currently is considering the tapering off of the fast tax write-off program for defense facilities (some natural gas companies have been granted certificates, but not so many). The contemplated new program would be used in areas of rising unemployment to encourage greater industrial activity.

Senator Capehart and those who agree with him say that this is the one sure way for Uncle Sam to encourage private expansion, without losing any real taxes. What Uncle Sam would lose in the first few years would come back in the long run when the plants were operating. What the government would lose resulting from the larger deductions for depreciation would be offset by the increased number of taxpayers created by the added plant investment.

Public utilities, including natural gas companies, faced with expansion programs, would be in a good position to take advantage of the "Capehart plan," if it were to win Congressional approval.

Service impairment by directive?

The 3rd United States Circuit Court of Appeals has upheld two Federal Power Commission orders relating to requirements levied on three separate companies by the FPC in connection with rate increases.

In one, the court has upheld an FPC order requiring Manufacturers Light & Heat Co. and Home Gas Co. to extend wholesale natural gas service to three small distribution systems in Pennsylvania. In another, the court upheld an FPC order which would require United Gas Pine Line Co., of Shreveport, La., to go ahead with the offering of evidence to justify the reasonableness of its gas rates.

In the first case, the companies (Manufacturers Light & Heat and Home Gas, both subsidiaries of the Columbia Gas System Inc.) contended that the FPC had no authority under the Natural Gas Act to direct them to extend service to new customers where the result would be the impairment of ability to service customers already attached.

The court found that the delivery of the volume of gas called for by the FPC's order would not alter the pipeline's supply system to any degree. It was noted that "actual deficiencies which the Columbia system has experienced in meeting the lawful demands of their customers have been on days of peak demand" in extreme winter conditions, and that it has been taken care of by curtailing deliveries for short periods to industrial customers. The court's opinion ruled that it was the intent of Congress, under Section 7(a) of the Natural Gas Act, to leave to the FPC the determination, on the basis of its informed judgment, of whether a service impairment would result from an order directing the delivery of gas to new customers.

In the second case, the United Gas Pipe Line Co. had contended that the FPC, as plaintiff, should present its case first because the FPC began the inquiry into the pipeline company's rates in 1948. A year ago, FPC ordered United to present evidence in this investigation, and the company appealed to the federal court. The court now has dismissed the appeal on grounds that the FPC's order was a matter of procedure and did not go into the merits of the case.

Incidentally, since the FPC inquiry was started, United Gas Pipe Line has filed a request for a $9.5 million rate increase, which, of itself, would require that the company would have to justify its rates and its proposed increases.

Dawdling into a dilemma

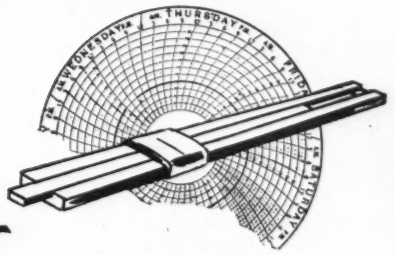
Despite an inherent conservatism, which, as should have long ago been detected, guides the policy of the editors, this column has a firm conviction that on certain matters at least a modicum of speed is in order. Progress that comes by the process of evolution certainly can use an occasional shove.

So it is that we would be somewhat amused by the fix into which our Canadian friends have maneuvered themselves by their persistent policy of "go-slow"—were it not for the tragic aspects of the affair. To date we have successfully resisted the impulse to take a stand on the Canadian-Northwest gas situation, contenting ourselves with giving complete news coverage of it—but the temptation to smile out loud is becoming too strong to keep down forever.

Some years ago—our clipping files are a little hazy as to the exact date—we tossed in the thought that a reciprocal agreement—Alberta gas for the Northwest and U. S. gas for eastern Canada—might be considered. This same suggestion was also given, unsolicited, by other observers, and some interested

Continued on page 78

Technical Trends



• By GUY CORFIELD

Offshore oil and gas

The National Petroleum Council's committee on submerged lands productive capacity has recently issued an interim report giving an estimate of the petroleum production that will probably be developed through an active continental shelf of the United States.

The continental shelf is considered to be the area extending seaward from the coast which is submerged in less than 600 feet of water (beyond which depth the slope of the ocean bottom generally increases rapidly). This shelf is relatively narrow along the West Coast (50 miles or less) but broad along the Gulf and Atlantic Coast (150 miles at some points). The total area is 278,000 square miles, but the immediately prospective area is 300 square miles to 50-ft depth off the West Coast and 14,000 square miles to 66-ft depth off the Gulf; these two areas are estimated to be capable of producing 200,000 bbl of oil and 700 MMcf of gas daily.

Now that the tidelands squabble between the Federal and State governments seems to be settled, returning ownership to the states to the 3-mile limit (10½ miles for the Gulf coasts of Texas and Florida), it appears that this production may be actually realized, as mechanical difficulties of working on and in the water have already been largely overcome through past experience.

Analyzing Noise

Industry in general is devoting increasing attention to noise and its control. Noise is not only annoying to the general public, but interferes with vocal communication within a factory or plant, and is not only disturbing to personnel but may be actually dangerous by causing nervous disorders or even deafness in extreme cases. In the gas industry familiar noise sources are regulators, valves and other gasways that restrict or change the direction of flow, and reciprocating compressors and, most recently, gas turbine centrifugal compressors.

The conventional and initial way of measuring noise is with a sound level meter that gives a reading in decibels. It has been found, however, that such a reading is usually not sufficient for an accurate, scientific and economical approach to remedial measures, and use is now being made of apparatus that will provide a frequency analysis of the noise. This type of apparatus has been standardized by the American Standards Assn. sectional committee Z24 on acoustical measurements and terminology under American Standard Specifications for an Octave-Band Filter Set for the Analysis of Noise and Other Sounds, Z24.10-1953. These specifications, including a general discussion of the problems of frequency analysis, the selection of the frequency bands, a bibliography, etc., can be obtained from the American Standards Assn., 70 E. 45th St., New York, N. Y.

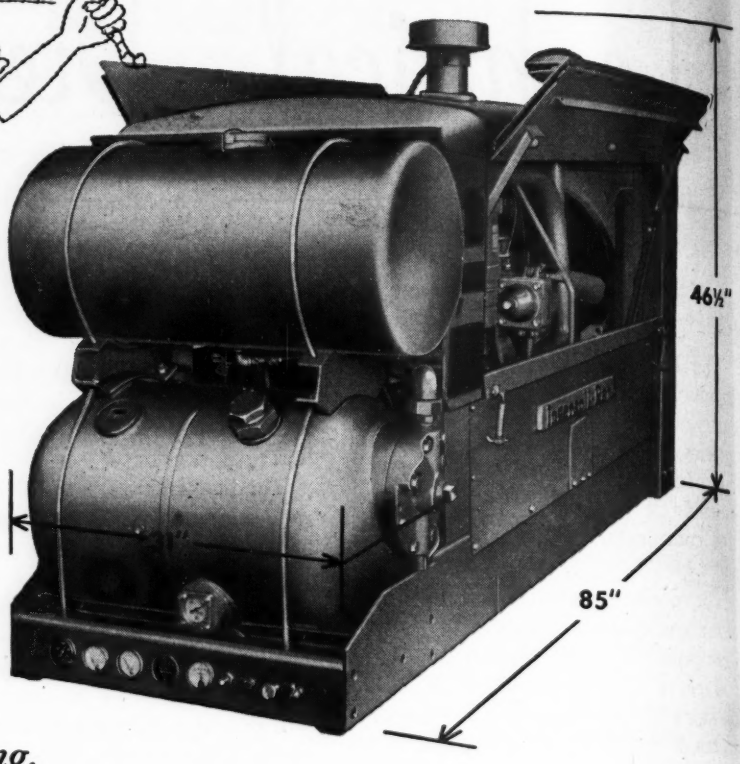
The practical application of these measurements is indicated by the following quotation from *Standardization,* April 1953:

"Let us consider the deafness risk question. Work done so far by a large number of investigators shows that the over-all noise level is not an adequate measure of its damaging effects. If a noise is principally a low-frequency one, such as that produced by low-speed motors, power transformers, and reciprocating engines, high levels can be tolerated. If, however, the noise has much energy at high frequencies, the tolerable levels are significantly lower. Because of this effect, a number of progressive companies are handling the problem in the following way: Before employment and periodically thereafter, audiograms are taken of personnel exposed to these high levels. The noise environment is also measured . . . by using a sound-level meter and an octave-band analyzer. This analyzer divides the audible noise spectrum into eight bands, ranging from a low-frequency band to a high-frequency one. This noise analysis is then compared with tentative criteria that a number of investigators have proposed (now under study by a subcommittee of ASA committee Z24) and which are based on an octave-band analysis. If this comparison shows the need for a reduction of the noise level, for example, because the levels in the upper bands appear too high, some remedial measures are taken. These control measures may be one of the following: Ear plugs may be worn by the exposed workers; a different and quieter production process may be substituted; or changes in the noisy machine may be made to reduce the noise level. Then the periodic audiograms will show whether or not adequate control exists.

"When noise levels are sufficiently high, speech communication may be impossible. As a result, shouted danger warnings may not be heard. Or, even at more moderate noise levels, it may be impossible to give instructions to the operator at a noisy machine. This interference with speech cannot be judged reliably on the basis of a single over-all measurement obtained on a sound-level meter, because the extent of the interference depends mainly on the intensity of the middle and higher frequency regions of the audible noise spectrum. Methods of rating this interference with speech on the basis of a frequency analysis of the noise have been devised. One simple method that is generally satisfactory rates the noise on the basis of the levels in three octave bands; namely, the bands covering the range 600-1200, 1200-2400, and 2400-4800 cycles per second. Then, the noise reduction needed to shift to a lower level of difficulty of speech communication can be estimated on the basis of presently available criteria."

(For an article on the subject of noise in compressor stations, see page 141 in this issue.)

"Plenty of room left for tools and men too!"



New

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ROTARY COMPRESSOR

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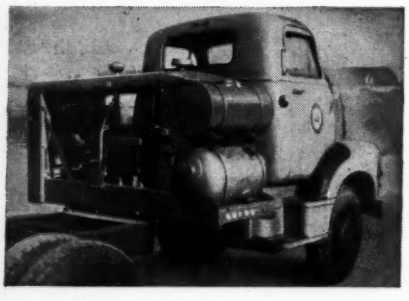

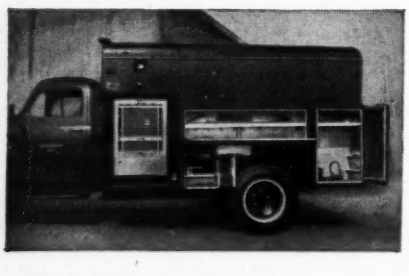

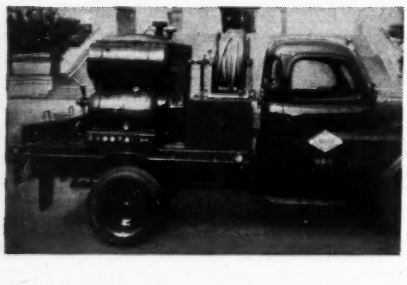

The self-contained GYRO-FLO 105 occupies a mere 70 cu ft of space and weighs only 2000 pounds. It is 51% smaller and 35% lighter than Ingersoll-Rand's former 105 cfm reciprocating model.

You can mount it on lighter, less costly, standard trucks for highly mobile service units. For traveling workshops, its extreme compactness allows maximum space for tools and personnel.

Only 7'1" long, this 105 compressor can easily be placed crosswise directly behind the driver's cab. It is built to conform readily to vehicle width limitations – with plenty of pipe carrying space available at the side. The control panel is conveniently located under the receiver at the curb end of the compressor.

The GYRO-FLO delivers full rated 105 cfm of compressed air at 100 psi. Having its own engine, the compressor can be removed and operated independently of truck.

- Other GYRO-FLO models include 105 and 210 cfm units on 2 wheel mounting, 210, 315 and 600 cfm on 4 wheels. GYRO-FLO's have no compressor valves to leak – no pistons, rings, rods or clutch to wear out. Discharge pressures are held between 100 and 110 psi throughout the entire capacity range of the machine. This means maximum efficiency in the operation of rock drills and air tools. And discharge temperatures are at least 100° lower than other compressors, assuring longer air-hose life.

There is a GYRO-FLO for your every portable compressor need – and your nearest I-R branch office will be glad to advise you on your particular problem.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

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COMPRESSORS • ROCK DRILLS • AIR TOOLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

Display of information tools at INGAA's public relations workshop in Dallas last month helped tell a graphic story of the job the association plans to do.

By MERLE CUNNINGHAM

First unified natural gas public relations program under way

THE new industry-wide public information program of the Independent Natural Gas Assn. of America, designed to give the public a better understanding of the natural gas industry, was inaugurated in Dallas, Sept. 10, with a workshop conference, attended by 115 members of the gas industry from 12 states.

The program, first of its kind ever attempted by the gas industry, was the theme of INGAA's annual meeting in Houston, Sept. 28-29. Another workshop, on a national basis like the first, will be held next spring, and thereafter, plans are for regional workshops quarterly.

Coordinating the three segments of the industry, production, transmission and distribution, the program has been set up for no definite length of time, but INGAA officials hope that it will "grow like Topsy" and continue indefinitely so long as there is a need "to more adequately inform the public on the operations of the gas industry." Although the program is supported financially by members of the association, the organization does not intend to limit use of the material it develops to its own membership.

"The active participation of companies in all other industry organizations is invited," said W. E. Wilson, director of public relations of United Gas Corp., who is chairman of INGAA public information advisory committee and served as workshop conference chairman.

W. E. Wilson (left), workshop chairman, traced the conception of the program and S. D. Whiteman told how his company intends to tie in with it.

AGA, IPAA, API, SGA, TIPRO, Mid-Continent Oil & Gas Assn., Panhandle Producers & Royalty Owners Assn., North Texas Oil & Gas Assn. and West Texas Oil & Gas Assn. were invited to take part in the program.

It is anticipated also, Mr. Wilson said, that others will be invited to participate, such as associations representing natural gas appliance manufacturers, oil field supply houses, and pipeline suppliers.

Bozell & Jacobs, advertising and public relations agency, with the advisory committee's assistance, is developing the program, which thus far includes material for newspaper and radio advertising, television, employee publications, stockholders' information, and speakers bureaus.

In addition, to Mr. Wilson, the following compose the advisory committee: C. P. Rather, president, Southern Natural Gas Co.; Joseph Bowes, president, Oklahoma Natural Gas Co.; Glenn W. Clark, president, Cities Service Gas Co.; N. W. Freeman, vice president, Tennessee Gas Transmission Co.; R. H. Hargrove, president, Texas Eastern Trans-

mission Corp.; J. J. Hedrick, president Natural Gas Pipe Line Co. of America; Paul Kayser, president, El Paso Natural Gas Co.; John F. Lynch, president, La Gloria Corp.; J. F. Merriam, president, Northern Natural Gas Co.; A. N. Rippel, manager gas division, Phillips Petroleum Co.; R. G. Taber, president, Atlanta Gas Light Co.; Tom P. Walker, president, Transcontinental Gas Pipe Line Corp.; and W. H. Wildes, president, Republic Natural Gas Co.

John A. Ferguson, executive director of INGAA, addressing the workshop, said, "Our program is different from most programs in that it places the burden on executives of companies. There will be no material used that has not passed the close scrutiny of this committee. In this way we hope to avoid any mistakes."

INGAA president C. P. Rather cited the need for a united consumer information activity for the gas industry. He said the producer, the pipeliner, and the distributor will better understand each other through working together in such a concerted effort. The other principal reason, he said, is to inform the public as to what parts of the gas industry are public utilities and regulated as such and those that are not.

"I am fearful," he said, "that in the minds of the public the entire natural gas industry is a public utility."

Regulation of gas production, which at present is a threat, will stifle the future discovery of natural gas, he said.

Although it is not in the public interest for natural gas to be in short supply, he added, the public does not understand these things and does not properly evaluate the industry.

Not one-shot program

"The program we have in mind is not a one-shot program," Mr. Rather emphasized. "It takes the constant repetition of an idea to make it take root and produce results. The first year of the program will not produce these results, nor will the second. It must be carried forward over a period."

Paul Kayser, president of El Paso Natural, who made the address at the luncheon, also emphasized that the purpose of the information program is to promote a clearer view of gas industry problems to each of the segments of the industry, and in turn, to get the basic facts over to the consumer.

Each segment, he stated, is dependent upon the other, "but all can prosper only as the consumer's interests are properly served."

UNANIMITY CAN BE ACHIEVED

"Anyone experienced in the natural gas industry can, with justification, be skeptical over the possibility of there being any unanimity in it. While I can understand this skepticism, I refuse to accept it because I so often hear my associates and friends throughout the industry ask the question: 'Why don't we get together?' I feel that there is a real awakening throughout the industry with regard to mutuality of problems. Yes, we will continue to wrangle and compete—that's helpful—but I believe any straight thinking person in the industry today will realize that the subject we are now discussing is one of common interest, entirely disassociated from any of our other problems, and one on which we should be able to work together in a united effort."

—C. P. Rather

Production is wholly dependent for its life on exploration and discovery, Mr. Kayser pointed out.

Tracing the activities that led up to the workshop, Chairman Wilson said that at the 1952 annual convention of INGAA, held last October at Omaha, President Rather was authorized by the board of directors to appoint a special committee to study the problems involved and to develop and recommend a public information program that would be industry-wide in nature. That step was an outgrowth of discussions at various INGAA meetings during the past on the need for such a program.

In January of this year, the INGAA special committee submitted its proposal for an industry-wide public relations program to the board of directors, along with suggestions for carrying out the program. The plan was adopted by the INGAA board of directors, and in March, Bozell & Jacobs was retained as counsel. Representatives of that agency talked first with a number of producers, both large and small, and the material presented at the workshop by Vincent Fowler, vice president of Bozell & Jacobs, emphasized production operations in the industry. Additional material, now being prepared, will stress the transmission and distribution activities of the industry.

One company's application

Appreciation for the INGAA public information program and how his company intends to use it were expressed by S. D. Whiteman of Hastings, Neb. president of Kansas-Nebraska Natural Gas Co., who addressed the workshop on "How An Information Program Affects Your Public—Nationally and Locally."

Mr. Whiteman said as his company grows, its public relations program not only becomes more important but, also, more difficult and requires more effort to carry out; so he looks upon the INGAA program as "the golden opportunity to strengthen and firm up the public relations program of our company."

He stated that his company also will encourage the distribution companies to whom it wholesales gas to tie in to the INGAA program, having already called a meeting at which those distributing companies will be asked to join in the 1954 advertising and public information program.

"We will carry out the INGAA themes in every way we can in every community throughout the territory we serve."

Mr. Whiteman thought it important that every segment of the industry follow the INGAA themes and use the INGAA work tools.

"If we do, it means your customers will be getting the same basic facts about our industry as my company's customers. It means that if a Nebraskan talks with his cousin in Texas or his uncle in Ohio, they will both have the same knowledge and understanding of the problems of the natural gas industry, and they will have the best information that this industry is able to provide for them."

Panel discussions in the afternoon session of the workshop brought out how the INGAA program might best be adapted to certain media.

M. H. North, advertising and sales promotion director of Oklahoma Natural Gas Co., led the panel on "Telling the Industry Story Through Various Means of Communication To and From Employees," and listed these major methods: the employee publication, employee

INGAA ADVERTISING READY
TO WORK FOR YOUR COMPANIES
and for the Gas Industry
LOCAL NEWSPAPER ADVERTISING MATS AND PLATES READY
MORE INGAA AD INFORMATION ON WAY TO YOU...
MORE ADS COMING YOUR WAY SOON !
FOR USE IN SALES PROMOTION ADS - PROGRAMS etc.
INGAA STOCKHOLDER RELATIONS AIDS
DO YOUR OWN STOCKHOLDER MAIL INSERTS
Create them from artwork and layouts available from INGAA
COPY IDEAS FURNISHED IN MIMEOGRAPH FORM

Other aids for promoting good stockholder relations and for institutional advertising were also displayed.

booklets, employee meetings, supervisors' training programs, and opinion surveys.

In enlisting the support of stockholders, Paul Hodges, Cities Service Co., New York, suggested these methods of keeping stockholders informed: direct personal contact, stockholder letters, responses to stockholders who write to management, annual reports, quarterly or interim reports, company magazines, dividend check mailing inserts, and occasional brochures.

Marshall Newcomb, general counsel and director of Lone Star Gas Co., Dallas, outlined the steps a company might take in organizing a speakers' bureau, which included: delegation of authority to supervise the operation, training of speakers, coordination with INGAA headquarters, and obtaining the proper news coverage of each speech.

Assistance to local speakers' bureaus will be given by the INGAA national speakers' bureau, recently organized in Washington under the direction of INGAA Executive Director Ferguson. A speakers' kit, containing statistics, speech texts, articles and quotations, is included in the material already prepared by the advisory committee and Bozell & Jacobs.

IT'S A GOING BUSINESS

At the 1952 annual convention of INGAA, held last October in Omaha, Neb., President Rather was authorized by the board of directors to appoint a special committee to study the problems involved and to develop and recommend a public information program that would be industry-wide in nature.

"In January of this year, this special committee submitted its proposal for an industry-wide public relations program to INGAA's board of directors, along with suggestions of procedures for carrying out the program. The plan was adopted by the INGAA board of directors, and in March, Bozell & Jacobs Advertising-Public Relations Agency was retained as counsel in this activity.

"Let me emphasize that this program is not a glint in somebody's eye. It is a going business! A number of companies—representing all segments of the natural gas industry—already have indicated that they intend to use the material (or adaptations of it) which you will see here today, and have said that they want other material as it is prepared."

—*W. E. Wilson*

Localization

John F. Lynch, president of La Gloria Corp., Corpus Christi, leading the discussion on "Localizing National Information Material for Press, Radio, and Television," emphasized that not all the information program will come from INGAA headquarters, but some of it will originate with individual companies.

INGAA headquarters, he said, would like to have a description of company films and copies of major news stories.

"Let's build up this two-way flow of information for the mutual benefit of us all," Mr. Lynch suggested.

Mr. Fowler of Bozell & Jacobs also called for comments and criticisms from anyone participating in the program. Copy in the ads, radio spots and other material may be edited or rewritten by individual companies or organizations if they see fit.

Proofs and copies of the prepared material have been mailed to all member companies of INGAA and are available to non-members who wish to contact INGAA, 918 16th St., N.W., Washington 6, D. C.

Four newspaper advertisements are available in full page or 5-col. by 15 in., each size in either two-color or one-color (black), and in 4-col. by 13 in., black only. The ads stress the importance to the consumer of encouraging discovery and production of natural gas to assure adequate, dependable supplies and what goes into the all-industry job of finding and producing, transporting and distributing natural gas. Either mats or plates may be ordered from INGAA headquarters at cost. Succeeding advertisements will be furnished on a two-a-month basis unless experience indicates member companies desire more advertisements.

THE EMPHASIS IS LOCAL

"This is completely and wholly a voluntary activity. It is not a 'canned' project in which the companies pay a certain fee toward its operation and then sit back and let the association publish the ads, make the speeches or release the news stories. Rather, it is a program which will require active participation by each individual company—and whether your company uses the materials or not depends largely on the decision of your management. You will place the ads, if you agree that they will be helpful in this all-industry effort. You and the people in your company will make the speeches. You will release the news stories. The Independent Natural Gas Assn. of America is providing the tools. It's up to you whether they are to be used."

—*W. E. Wilson*

Radio spot announcements and employee information tie in with the newspaper ads and the general theme of the program.

The workshop was held primarily for advertising, information and personnel department employees of the gas industry but also drew numerous executives.

Max Barnes of Bozell & Jacob's Washington office, and W. T. Pfeiffer of Shreveport, head of the agency's southwest division, assisted in the presentation of the information program at the workshop.

Economics of peak shaving natural gas

By C. T. CHAVE and B. C. WHITE
Stone & Webster Engineering Corp., New York

WEATHER PATTERNS . . .

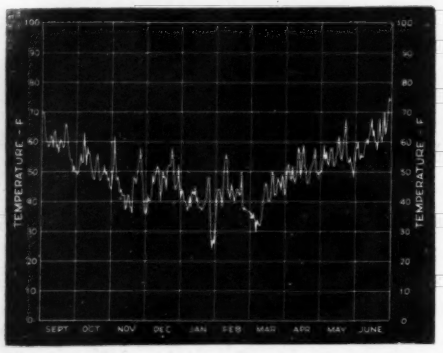


Fig. 1. Weather pattern for Tacoma, 1950-1951.

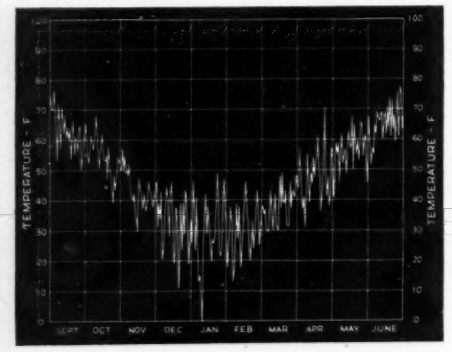


Fig. 2. Weather pattern for Boston, 50-year average.

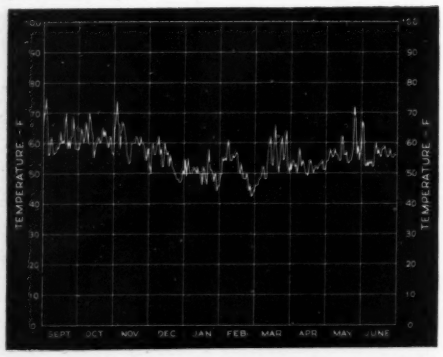


Fig. 3. Weather pattern for San Francisco, 1950-1951.

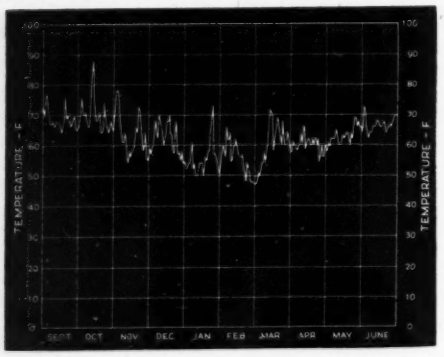


Fig. 4. Weather pattern for Los Angeles, 1950-1951.

THE need for peak shaving facilities on a manufactured gas system is fairly obvious—they keep down the size of the gas generating plant. The gasholder is the simplest device for peak shaving. In competition with gas storage facilities are propane-air sendout plants, oil gas sets, and oil reforming units. Usually, a natural gas distribution system has no manufacturing facilities, and it is the demand charge made by the pipeline company that is the driving force for peak shaving on such a system.

The two-part rate, with a demand charge and a commodity charge, is not a thing of perfection. Nevertheless, it is a great economic concept, working in the direction of the most efficient use of transmission lines and the lowest delivered price for natural gas. It is an attempt to separate fixed charges on the transmission system and operating costs of supplying the gas.

When a customer even momentarily demands firm gas at a certain rate, he is asking that a portion of the gas transmission system be reserved for his use. It is logical that he should pay for this privilege, regardless of how much total gas he uses. The only questions unsettled are how much of the transmission facilities he is tying up, and how much he should pay.

Two-part rates vary with different gas transmission companies and with customers, depending to a great extent where they are taken off the pipeline and how their demands affect system load factor. The following rates are typical:

	Monthly Demand Charge Per Max. Daily Mcf	Commodity Per Mcf
New England	$4.50	$0.30
Middle Atlantic	2.60	0.257
Northwest (proposed)	3.20	0.20
Southern California	1.60	0.16

The economics of peak shaving depend on these rates, for peak shaving would be of no value for only a commodity rate basis of billing. It also depends upon the load curve for the distribution system. Obviously, the miracle system with 100% load factor gains nothing from peak shaving, while a system having only one high peak day a year can spend a substantial sum to reduce this peak demand.

The results of the application of two-part rates, in terms of actual cost of gas furnished during peak periods, show figures of $2, $3 or even $20 per Mcf!

Anyone in the gas business knows that cooking habits of customers vary but little from day to day, so that daily load factor is not seriously affected. We all know that space heating is the principal contributor to fluctuating load, and that variable weather is the controlling cause. Going along the coast from north to south, we have temperature variation curves for four large cities. *Fig. 1* is for Tacoma, Wash., for 1950-1951. The weather here is not in any way compar-

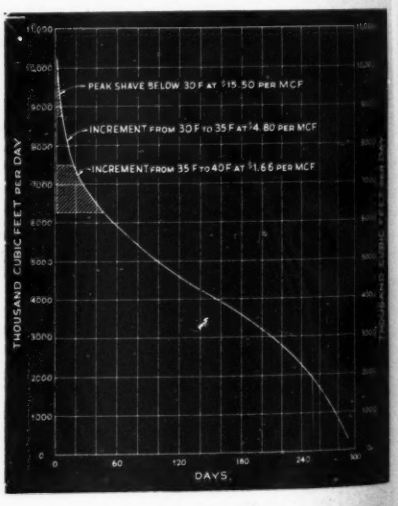

PEAK SHAVE BELOW 30 F AT $15.50 PER MCF
INCREMENT FROM 30 F TO 35 F AT $4.80 PER MCF
INCREMENT FROM 35 F TO 40 F AT $1.66 PER MCF
THOUSAND CUBIC FEET PER DAY
DAYS

Fig. 5. Load duration curve for Tacoma, September 1950-June 1951.

This article has been adapted from a talk presented at the annual meeting of the PCGA in San Francisco, Sept. 9-11.

...AND THE COST OF PIPELINE GAS

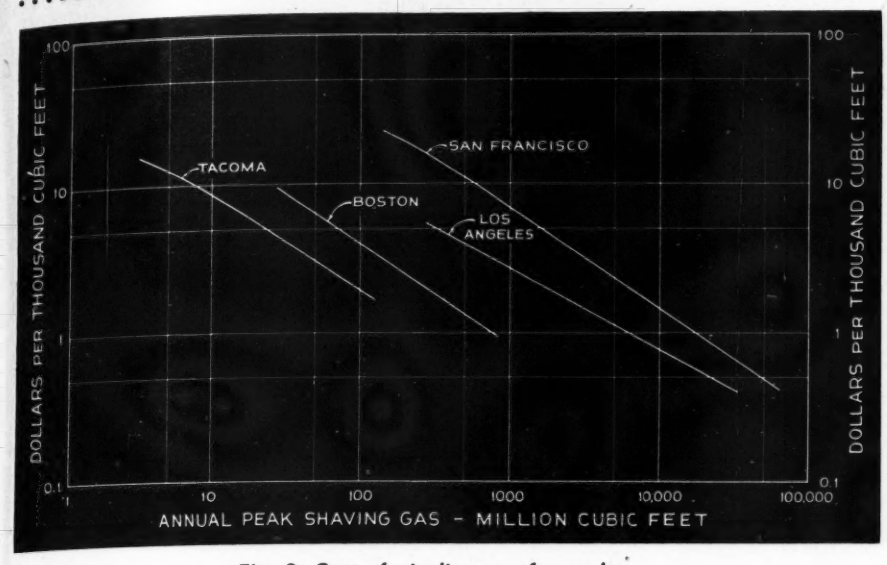


Fig. 9. Cost of pipeline gas for peaks.

able to Boston weather, but it does jump around.

In Boston, for which the average temperature variation curve for 50 years is given in *Fig. 2,* the weather extremes are hotter in summer and colder in winter than for Tacoma. However, the sharp winter peaks are not much worse than for Tacoma; in January in Boston there is a peak about 27° F below the average, while in Tacoma it is about 17° F. We can do very little about the difference between summer and winter loads by peak shaving, but we can reduce the daily peaks.

Moving south to San Francisco, the weather pattern for 1950-1951 is shown in *Fig. 3.* The steadiness of the climate is striking, and the two winter peaks of consequence are only about 5° to 7° F below the average January and February weather.

Proceeding to Los Angeles, the 1950-1951 weather pattern is given in *Fig. 4.* Here we have a series of peaks, again about 7° to 10° below the average for January and February, with rather broad bases. To shave these peaks to the average would take a lot of gas, as compared with the narrow peak for Tacoma.

The rate of heating gas sendout is almost a straight line relationship to the daily mean temperature. For any given system, so many Mcf per day will be sent out for each degree below the base temperature. Once the weather pattern for a locality is established, this number may be readily obtained from the gas company records, and a load variation curve plotted. However, load variation curves look just like temperature variation curves with sendout rate replacing the temperature ordinate. As a result, the peaks are inverted.

What we are trying to grasp from such curves is the number of peaks, their extent and their duration. For this purpose, temperature and load duration curves are more useful than curves of sendout rate versus calendar time. In these duration curves, the peaks are all plotted next to each other in descending order of size.

Load duration curves, corresponding to the temperature variation curves previously shown, are given in *Figs. 5, 6, 7* and *8* as developed from typical data. The cost data are the result of applying the rates cited earlier. Note that the area under the curve represents the total Mcf of gas sent out. *Fig. 5* is the duration curve for Tacoma for 1950-1951. It is only the small shaded peak at the left of the curve which is susceptible to peak shaving.

By applying suitable two-part rate charges to the gas in these peaks, we can see what it costs and thereby judge whether we can send out peak shaving gas for less money.

The very tip of the Tacoma peak would cost $15.50 per Mcf, with a total sendout of 3.75 MMcf. This is for peak shaving below 30° F. The next increment from 30° to 35° F, representing 10 MMcf, would cost $4.80 per Mcf. Finally, the large area from 35° to 40° F, representing 34.1 MMcf, would cost $1.66 per Mcf.

The problem is to match up these

...LOAD DURATION CURVES

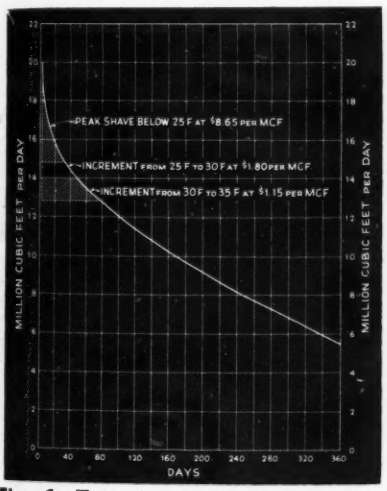

PEAK SHAVE BELOW 25 F AT $8.65 PER MCF
INCREMENT FROM 25 F TO 30 F AT $1.80 PER MCF
INCREMENT FROM 30 F TO 35 F AT $1.15 PER MCF
MILLION CUBIC FEET PER DAY
DAYS

Fig. 6. Typical load duration curve for Boston.

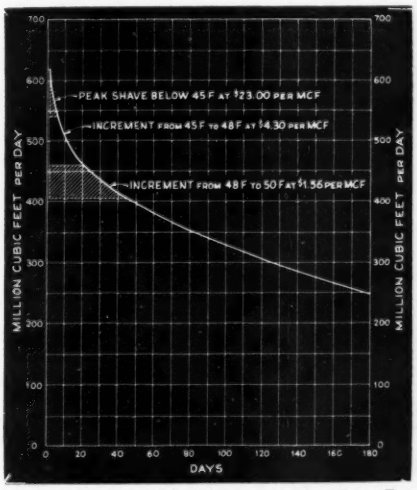

PEAK SHAVE BELOW 45 F AT $23.00 PER MCF
INCREMENT FROM 45 F TO 48 F AT $4.30 PER MCF
INCREMENT FROM 48 F TO 50 F AT $1.56 PER MCF
MILLION CUBIC FEET PER DAY
DAYS

Fig. 7. Load duration curve for San Francisco, September 1950-June 1951.

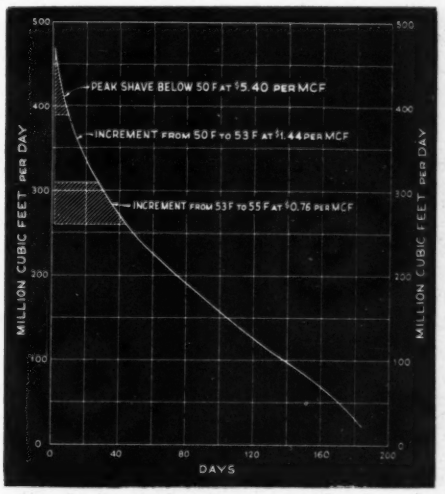

PEAK SHAVE BELOW 50 F AT $5.40 PER MCF
INCREMENT FROM 50 F TO 53 F AT $1.44 PER MCF
INCREMENT FROM 53 F TO 55 F AT $0.76 PER MCF
MILLION CUBIC FEET PER DAY
DAYS

Fig. 8. Load duration curve for Los Angeles, September 1950-1951.

volumes of gas with the same volumes of peak shaving gas at less cost.

Now, turning to Boston, *Fig. 6* gives a load duration curve for a typical year. The very tip of the Boston peak would cost $8.65 per Mcf, with a total send-out of 32.4 MMcf. This is for peak shaving below 25° F. The next increment from 25° to 30° F, representing 43 MMcf, would cost $1.80 per Mcf. Finally, the increment from 30° to 35° F, representing 63.3 MMcf, would cost $1.15 per Mcf.

An examination of *Fig. 7* for San Francisco shows a reasonable peak shaving area up to 50° F. Peak shaving gas below 45° F represents 140 MMcf at $23 per Mcf. For 45° to 48° F, we have 749 MMcf at $4.30 per Mcf and, from 48° to 50° F, 1675 MMcf at $1.56 per Mcf.

Fig. 8 for Los Angeles shows a substantial peak below 50° F, representing 286 MMcf at $5.40 per Mcf. The increment from 50° to 53° F represents 1170 MMcf at $1.44 per Mcf, and the increment from 53° to 55° F indicates 1640 MMcf at 76 cents per Mcf.

Fig. 9 shows curves giving the price of peak gas in all of these localities versus the total amount of gas used. Now, to complete the picture, all we have to do is to determine the equivalent cost of peak shaving gas.

Peak shaving may be accomplished in two different ways: manufacturing a gas cheaper than the cost of the peak gas, or storing gas for release in peak periods.

Let us turn our attention to manufacturing for a natural gas system. The gas produced must have a heating value somewhere in line with natural gas. This eliminates water gas and coke oven gas from consideration. We become limited at once to cracking liquid fuel by reforming or the use of oil gas sets.

The cost of gas made by such cracking depends on the cost of the feed stock, its heating value, and the conversion efficiency of the process. For example, in reforming propane to 1000 Btu per Mcf gas, the cost of liquid fuel per Mcf of gas is developed as follows:

$$\frac{\text{¢ per gal.}}{\text{E* conversion efficiency}} \times 92{,}000 \text{ Btu/gal.} = \text{¢ per Btu}$$

$$\text{¢ per cu ft} = \frac{\text{Btu}}{\text{cu ft}} \times \frac{\text{¢}}{\text{Btu}}$$

$$= 1000 \times \frac{\text{¢}}{\text{Btu}}$$

$$\text{¢ per Mcf} = 1{,}000{,}000 \times \frac{\text{¢}}{\text{Btu}}$$

$$\text{¢ per Mcf} = \text{¢/gal.} \times \frac{1{,}000{,}000}{92{,}000 \times \text{E* conversion efficiency}}$$

FUEL COSTS

PROCESS	HEATING VALUE OF REFORMED GAS	SAN FRANCISCO AREA, FEED STOCK	CENTS PER GAL	CONVERSION EFFICIENCY	FUEL COST OF GAS, CENTS PER MCF
KOPPERS-HASCHE	1,000	NAPHTHA	17.3	98	$1.36
UGI-CCR	233	NAPHTHA	17.3	81	0.383
UGI-CCR	533	KEROSENE	15.6	75	0.816
UGI-CCR	689	KEROSENE	15.6	65	1.22
SURFACE COMBUSTION	540	PROPANE	6.9	74.5	0.544
GAS MACHINERY CO.	1,000	PROPANE	6.9	93	0.806
GAS MACHINERY CO.	1,000	BUTANE	8.9	91.3	0.903

Table 1. Fuel costs of reformed gases.

At 10¢ per gal., cost per Mcf $= \frac{\$1.085}{E}$

where E* is the conversion efficiency.

In reforming, the liquid fuel is cracked thermally or catalytically into hydrogen and other lower molecular weight hydrocarbons, and steam and air are sometimes added. The efficiency depends on the fuel, the heating value of the gas produced, and the process. The approximate conversion efficiencies of some processes and the fuel cost for gas are shown in *Table 1*.

The investment cost for such a plant is always higher than the cost of a propane-air plant although labor charges are similar. It is evident from this that reforming cannot compete with propane-air for shaving on a natural gas system.

It has its place, however, in a mixed gas system using propane for peak shaving. On such systems propane interchangeability is strictly limited because of its different burning characteristics. By reforming, fast-burning hydrogen can be made which, when mixed with propane-air, produces a gas of suitable burning characteristics.

Oil gas can be made as a peak shaving gas in new or converted water-gas sets. This is a common practice when natural gas is first brought to an existing distributor. In converting water-gas sets to oil-gas operation, the capacity will be increased about as follows:

Light oil, single generator	16.7%
Light oil, twin generator	66.7%
Heavy oil, twin generator	8.3%

In addition, there is a benefit obtained since the oil gas has a higher heating value than the original water gas. *Table 2* shows the details of the cost of oil gas from light oil, while *Table 3* shows the cost of oil gas from heavy oil. In addition to the costs given in these tables an annual labor cost of $7 per Mcf of daily capacity should be added.

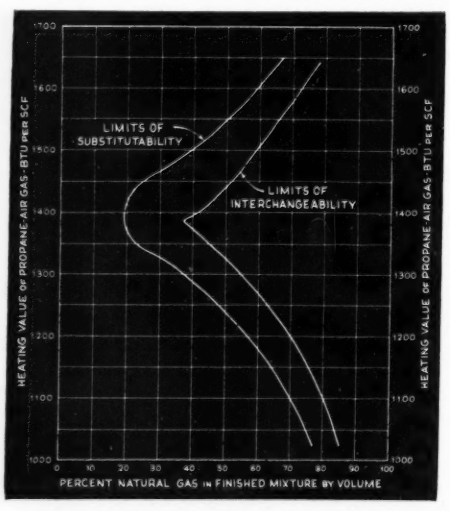

LIMITS OF SUBSTITUTABILITY
LIMITS OF INTERCHANGEABILITY
HEATING VALUE OF PROPANE AIR GAS - BTU PER SCF
PERCENT NATURAL GAS IN FINISHED MIXTURE BY VOLUME

Fig. 10. Limits of interchangeability and substitutability of propane mixes with 1050 Btu high methane natural gas.

Capital charges increased

For the heavy oil conversion, it is commonly found that the cost of additional equipment required over and above that needed for the use of light oil generally increases capital charges more than enough to offset the reduced cost of fuel when such an installation is used principally for peak shaving. It should also be borne in mind that the heavy oil-gas process is not as flexible as some of the others.

Turning from manufacturing to storage, the old standby is propane. It has one drawback — interchangeability. To burn propane successfully on a gas range which can also burn natural gas, it must be mixed with air. Even then it behaves differently from methane, and hence cannot usually be substituted 100% due to the range of appliance adjustments. However, the interchangeability depends on the appliance adjustment and, under some circumstances, it may be substituted 100% for a natural gas mix. Interchangeability of propane-air mixes is a maximum at heating values between 1350 and 1450 Btu per scf. *Fig. 10* shows

	UNIT COST	PER MCF		COST PER MCF
GAS OIL, PER GAL (No.2)	$.10075			
TAR, PER GAL	.05			
STEAM, PER 1,000 LB	.70			
LIGHT OIL, PER GAL	.056			
HEAT AND MAKE OIL		14 GAL		$1.410
TOTAL STEAM		139 LB		.097
				$1.507
RESIDUAL TAR		2.32 GAL	$.116	
RESIDUAL LIGHT OIL		0.40 GAL	.022	
				.138
				$1.369
PURIFICATION AND MAINTENANCE				.025
				$1.394

Table 2. Unit costs and rates for oil gas from light oil.

	UNIT COST	PER MCF		COST PER MCF
BUNKER "C" OIL, PER GAL	$.05			
TAR, PER GAL	.05			
STEAM, PER 1,000 LB	.70			
LIGHT OIL, PER GAL	.056			
HEAT TAR		.68 GAL		$.034
MAKE OIL		11.33 GAL		.567
TOTAL STEAM		117 LB		.082
				$ 683
RESIDUAL TAR		2.83 GAL	$.141	
LIGHT OIL		0.40 GAL	.022	
				.163
				$.520
PURIFICATION AND MAINTENANCE				.025
USE $.55 PER MCF OF 1,000 BTU GAS				$.545

Table 3. Unit costs and rates for oil gas from heavy oil.

the limits of interchangeability and substitutability* of various propane mixes with 1050 Btu high methane natural.

For low pressure systems, it is not necessary to provide air compressors to supply the diluent air. By vaporizing the propane at 60 psi or more, jet compressors may be utilized against back pressures as high as 2 psi gauge.

For higher distribution system pressures, air compressors would be required. The horsepower and equipment costs will vary with the hourly capacity sendout pressure and heating value of the propane-air mix. If the sendout pressure is high, consideration should be given to designing the plant for operation on the highest heating value mixture possible at maximum plant capacity. This would permit reduction of the compressor horsepower installed and thereby reduce the capital charges. Of course, operation at this higher heating value would entail some metering loss which should be recognized in any economic evaluation.

The cost of propane-air plants may be divided into two parts, the storage facilities and the compressor and mixing plant. The storage facilities will vary in cost somewhat when tanks are used, depending upon the tank protection that is provided. Generally speaking, this cost will be in the range of 60 to 90 cents per gal. of storage capacity or, on the basis of equivalent 1000 Btu gas, $6.50 to $9.50 per Mcf.

Storage of propane in manually excavated caverns has come into use by propane marketers in recent years. Studies of this form of storage would indicate that cavern storage of propane would be economical for anyone considering the storage of more than 250,000 gal. It is quite economical to excavate rock, and caverns made in this manner cost from 63 to 20 cents per gal. of propane stored. It should also be pointed out that cavern storage is extremely safe and temperatures are essentially constant.

When it is possible to wash out salt formations for propane storage, the cost of storage can be reduced to as low as 4.5 cents per gal. for a storage capacity of 50,000 bbl.

The cost of the compressor and mixing plant can, in general, be reduced to a unit cost per brake horsepower when air must be compressed. This figure ranges from $300 to $620.

Fig. 11 shows the cost of propane-air using rock cavern storage delivering to a distribution system at 250 psi gauge. The sendout rate is based on the maximum sendout rate per day, in this case 6% of the storage capacity. The cost approaches a minimum of about $1.90 per Mcf, and goes up to about $3 for smaller plants.

Fig. 12 gives the same analysis for 50 psi gauge sendout pressure, with a minimum cost of gas of about $1.75 for a very large plant.

The cost of gas includes fixed charges at 15%, labor, propane at 11.7 cents per gal., and utilities. Propane at 11.7 cents per gal. means a cost of $1.27 per Mcf of natural gas equivalent at 1000 Btu per scf so that these curves may be corrected for the current price of propane.

Liquefaction of natural gas is still very much in the running as an economical peak shaving method.

A natural gas liquefaction plant may be considered to perform three functions: liquefaction, storage, and regasification. Liquefaction is done by compressing the gas and chilling it with boiling ethylene, which in turn is compressed and chilled with boiling propane. The propane is then compressed and condensed with cooling water. Such a system is called a cascade. The cost of this portion of the plant depends on the rate set for filling storage. The size of the storage affects the size of facilities for reliquefying the vent gas. The amount of vent gas is really quite small but, when the filling of the liquefaction plant is extended over a 300-day period, the plant capacity devoted to reliquefaction of the vent gases is a fair portion of the total plant capacity. The filling time should be about this long to provide an economical plant.

Liquefied natural gas may be stored in low pressure vertical cylindrical tanks with flat bottoms and self-supporting roofs. The tanks must be heavily insulated. Double wall vessels are used with about 3 ft of Foamglas insulation between the walls. The inside vessel is fabricated of Type 304 stainless steel, which has an acceptable Charpy impact test at the storage temperature of —250° F.

Any liquefaction plant which is built today should follow the recommendations of the Bureau of Mines Report of Investigation 3867. It is obvious that such a plant would not be possible near a large metropolitan area.

For a plant with a 10-month filling time, the cost of storage is about 50 to 70% of the cost of the whole plant. However, the cost is only about $5 per Mcf, or 41 cents per gal. This is very cheap. Think of gasholders at about $200 per Mcf! While the cost per gallon is greater than that for propane storage in caverns, it is less than propane tank storage.

We have speculated on the feasibility of cavern storage for liquefied natural gas. The vent losses would increase several fold, but the reduced cost of storage might more than make up the difference. However, the behavior of rock under low temperatures will take a great amount of study before the responsible engineer will rush right out to try it.

Regasification facilities consist basically of pumps, controls, and heaters. Their

*Substitutability refers to the amount of propane air peak shaving gas which can be used during emergency periods with a tolerable level of customer complaints as compared with interchangeability, which presupposes no customer complaints.

STORAGE COSTS

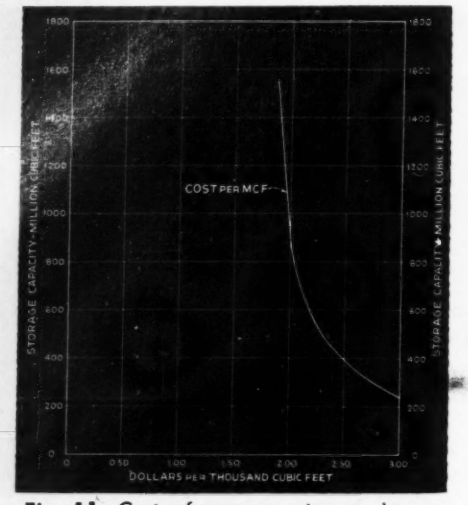


Fig. 11. Cost of propane storage in caverns at 250 psig sendout.

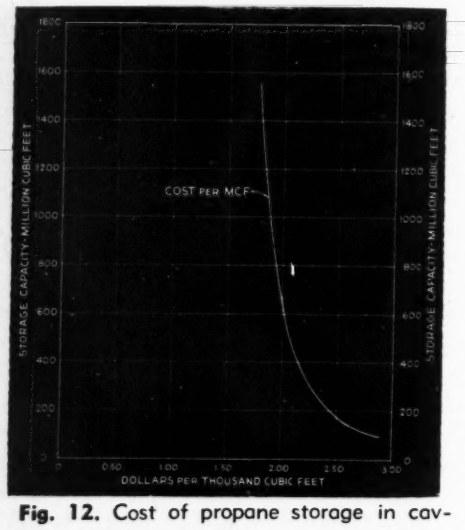


Fig. 12. Cost of propane storage in caverns at 50 psig sendout.

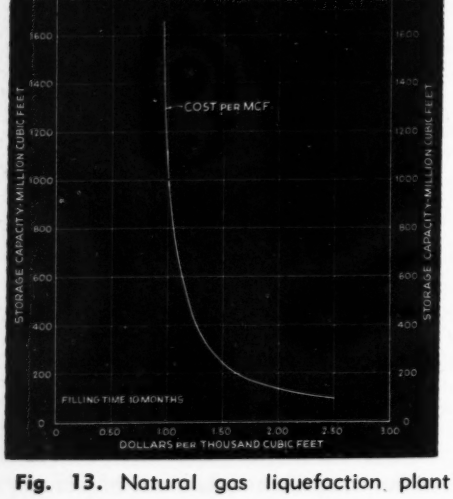


Fig. 13. Natural gas liquefaction plant gas costs.

cost is small compared to that of the other facilities.

Considering the whole liquefaction plant, the gas costs are given in *Fig. 13* for plants with a filling time of 10 months and a sendout time of two months. Plotted on this curve is the cost of gas, including fixed charges, labor, materials, fuel, and supplies. For a large plant, the cost of peak shaving gas would be less than $1 per Mcf and, with 140 MMcf of storage, a cost of $2 per Mcf would be obtained. This is less than propane and gives rise to the question: "Why a propane plant?" The answer is that the capital cost is higher. Five million dollars will buy 700 MMcf of liquefied natural gas storage capacity as compared to 1500 MMcf of propane storage capacity. However, the propane itself costs more money. So if you want to do average weather peak shaving, you choose liquefied natural gas; if you want standby storage, or perhaps storage for severe weather, you would choose propane.

Geological formation best

The ideal gas storage plant is a natural geological formation. A pervious sand sealed by an impervious cap of rock is desired, and a played-out gas field meets this requirement. On the Atlantic seaboard, we do not have any gas fields, but if we could find some dry hole country that would retain gas, we would be mighty lucky. Of course, finding it is something else.

Again the costs for such an installation may be divided into three parts. Compressor plant costs will be similar to those at the pipeline station, and will vary with the installed horsepower.

Storage costs will vary over a wide range with many factors influencing the final figure. For storage in depleted gas fields, the cost will probably be at a minimum. Depleted oil wells may offer another type of formation but it will cost more than the converted gas field.

In cases where neither of the previous two formations is available, the cost would be increased by exploration and development. It has been reported that the investment for the Herscher project in Illinois will be $17 million before any gas will be available for withdrawal. Since the net available storage capacity of this installation is 90 billion cu ft, the plant cost, including all facilities, is about 19 cents per Mcf, or 15.6 cents per Mcf without the compressor plant.

Experience gained in the Appalachian area shows that gas storage costs average 15 cents per Mcf of gas withdrawn.

Sendout facilities for such a natural formation will vary from the simplest form with just a control valve to an installation including dehydration, gas heating and compressor facilities. The dehydration will be necessary if there is a water drive to the formation.

With the low cost of gas of 15 cents per Mcf for a large installation, it becomes possible to do considerable peak shaving. Instead of running only for days, it is economical to operate for weeks.

Now let us assemble all of these peak shaving gas cost data on one curve, and then tie them into the pipeline gas cost curves previously shown. *Fig. 14* shows the cost of peak shaving gas and pipeline gas for peaks, with propane at various delivery pressures and prices, liquefied natural gas, and gas stored in formations.

It is fairly evident that Tacoma could not afford to do any peak shaving with propane-air at 50 psi gauge, or higher, or natural gas liquefaction. It might be that if a curve were added to this chart for propane-air at 1 to 2 psi gauge, the Tacoma load curve would intersect this new curve indicating that peak shaving economies could be made utilizing this material.

For the Boston area it is apparent that either natural gas liquefaction or propane-air at 50 psi gauge would be economical for loads up to about 750 MMcf for liquefaction and 250 MMcf for propane-air.

In the case of Los Angeles, the loads are of such magnitude that the pressure of the propane-air sendout makes no difference, and quantities up to 2500 MMcf could be sent out annually for peak shaving purposes on an economical basis.

For the San Francisco area with greater sendouts, propane-air at 50 psi gauge or natural gas liquefaction would be economical for loads up to approximately 10,000 and 25,000 MMcf respectively.

Most economical storage

We have added to *Fig. 14* a curve for the approximate cost of gas handled for the natural formation, and it is quite evident that such a formation, if it can be found, provides the most economical storage. The curves for propane-air drawn on this chart are based on propane at 11.7 cents a gal., and the cost of the propane gas should be adjusted for the price prevailing in the specific area.

It does not take much imagination to see from these curves that propane-air is indicated for the small installation, with liquefaction or underground storage indicated for the large peak shaving job.

The price of propane has a great bearing on this question. In the East, Central and Northwest states, a good part of the cost of propane is for tank car freight. It seems obvious that propane can be moved cheaper in a natural gas pipeline by injecting it in the gas on the way to the market. Recent studies show that the cost of moving propane this way is 2 to 3 cents per gal. per thousand miles, with an extraction cost of 2 cents per gal. That should make propane available in San Francisco at 4.5 to 6 cents per gal. shipping cost. What remains to effect this result is for the Federal Power Commission to approve this method of transportation, and to build some plants. The pipeline companies are certainly interested in having their customers use peak shaving. It improves their load factor, and they can sell more gas.

As opposed to peak shaving by storage, there is peak shaving by cutting off industrial customers. Peak shaving allows some of this industrial load to be made firm, and the cost per Mcf of peak shaving by dropping load is arrived at by the following formula:

$$C = \frac{A\ (F-D)}{P}$$

C = $/Mcf of peak gas
A = Annual Mcf of industrial gas
F = $/Mcf of firm gas
D = $/Mcf of interruptible industrial gas
P = Annual Mcf of dumped peak gas

Debatable point

It is assumed that the industrial gas could be sold as firm gas if a peak shaving plant were installed. This assumption might be open to debate, especially since all of this gas might not be salable in summer.

For a dump gas rate of 26 cents per Mcf and a firm gas rate of $2 per Mcf, and using dump gas to the extent of 75% of the total industrial gas, we obtained by this method the cost of $2.43 per Mcf for peak shaving gas. This cost is as high as peak shaving gas from a propane-air installation. In fact, if the interruptible gas quantity were reduced, peak shaving by this method would be uneconomical. Conversely, if all industrial gas could be made interruptible, the cost of such peak gas would be kept to a minimum. The higher the price that can be obtained for this interruptible gas, the lower the cost of the peak gas. The cost of industrial dump gas must be competitive with other fuels and this sets the maximum price obtainable for the gas sold on an interruptible basis. We must also recognize that the Federal Power Commission is tending to limit the use of natural gas to the residential and commercial market.

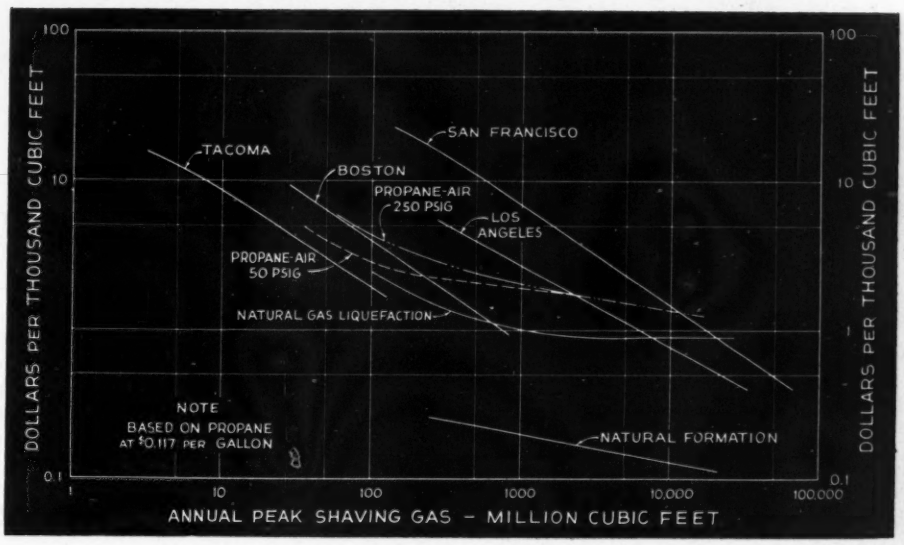


Fig. 14. Cost of peak shaving gas and pipeline gas for peaks.

These are all the meat axe tools. It takes a little more skill to handle the fine points. However, there are some interesting angles. First of all, the rate of load growth is important. If the load is growing rapidly, there is more use for peak shaving, because the peaks become greater each year. The terms of the contract are also important. If an established demand is irrevocable and a company is on the verge of obtaining a natural reservoir, it may pay to put in temporary facilities to keep the peaks down until the reservoir can go into operation. However, the situation rarely occurs where it is possible to foresee a reduction of demand or an opportunity to hold the gain to a fixed point in the future. When a gas company is prospecting for a storage field, it is gambling for high stakes; hence, a contract which sets up irrevocable demand charges is bad for the interests of the pipeline company, because it discourages planning of future peak shaving facilities with the resulting improvement of pipeline load factor.

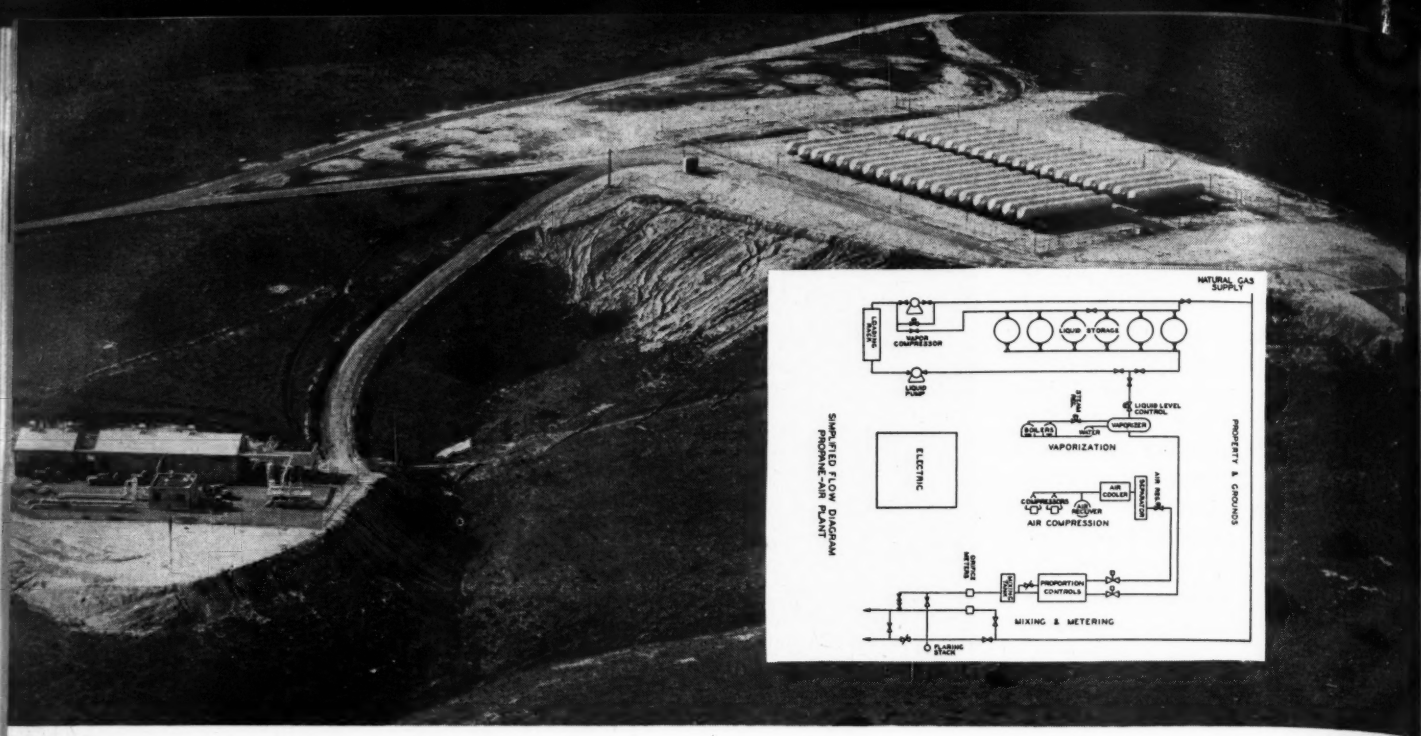
So far we have talked about average weather peak shaving only. Average weather conditions are perhaps not the correct basis for design purposes. However, it is going to take a great amount of work to establish the correct basis. Obviously, it is the type of weather which would balance peak shaving gains against losses and allow the desired average profit for the operation over a period of several years. Based on the experience of at least one gas company, average weather seems to be a little bit on the conservative side; that is to say, more peak shaving could be done profitably.

The method of handling design for unusually cold weather on a precise basis has not been developed because in that case the penalty of not being able to carry the load must be evaluated. The evaluation is made much easier if it is possible to cut off industrial customers rather than domestic customers. Most gas companies that cannot dump industrial loads make every effort to carry their forecast load and, therefore, put in extra storage over and above that for average weather peak shaving. Our weather records are only about 50 years old and probably do not give us enough information to evaluate to a nicety the chances involved. The evaluation of these risks presents a real challenge to mathematicians of the insurance actuary type.

Combination of plants

In designing for severe winters, the facilities should be chosen more from the point of view of lowest capital investment rather than from the point of view of lowest cost of peak shaving gas. For this reason a combination of plants, such as liquefied natural gas for peak shaving and propane-air for severe winter operation, may look attractive.

A specific study requires more refined tools and a much more detailed analysis than can be made from the data given in this article. We hope, however, that it throws a little more light on the general economies.



Aerial view and schematic diagram of propane standby plant at San Diego Gas & Electric Co.

Painstaking inspections keep seldom-used standby plant in readiness

By **M. R. ENGLER** • San Diego (Calif.) Gas & Electric Co.

The reliability of a standby propane-air plant which is normally idle and used only as an emergency supply will be certain only so long as all component parts of the system receive periodic care and attention. The inspection procedures adopted by the San Diego Gas & Electric Co. at their standby plant can well be used as a model operation of this kind. Since its erection in 1949, the San Diego installation has been on stream for as long as eight hours at a time at maximum and lower rates and no difficulty due to rust, corrosion, scale or faulty equipment has been encountered. On trial runs the plant has been put into full operation within 20 minutes after arrival of operating personnel.

Inspection and maintenance procedures at San Diego have been set up on check sheets which follow through the system from the unloading rack to the mixing and metering equipment. A thorough inspection of the entire plant is undertaken monthly, and a routine weekly check is made of the air compressor system. An annual inspection of the plant is outlined on a separate check sheet and includes test procedures not undertaken monthly.

Adapted by *GAS* editorial staff from paper presented at the PCGA distribution conference in San Jose, April 28. Photos by *GAS*.

NORMALLY inspection starts with the unloading rack *(Fig. 1)*. The unloading pumps are energized to insure free running; and all hose couplings and swivels are checked for wear, leaks or other deterioration. Annually, or while pumping liquid from a tank, the pump discharge valve is closed to test the back pressure relief valve. Proper operation of the valve is indicated by equal pressure

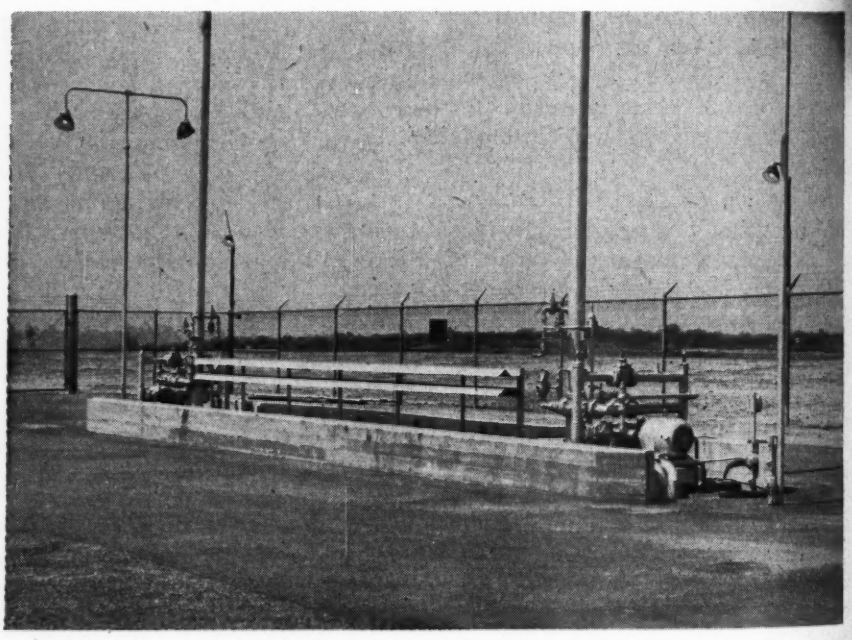


Fig. 1. Unloading rack at the San Diego standby plant. Propane is unloaded with two Smith model MC-3 pumps driven from a 7½-hp squirrel-cage motor. One such arrangement is provided at each end of the unloading rack so that two trucks and trailers can be unloaded at the same time.

MONTHLY INSPECTION

PROPANE PLANT

	Observed Setting or Condition	Date Performed
I LIQUOR STORAGE		
Unloading Rack		
Energize Unloading Pumps		
Check Swivel Hose Connections		
Check Hose Condition		
Exercise and Grease Valves		
Vapor Compressor		
Energize Compressor		
Check Lubricating System		
Check Back Pressure Relief (100 psi)		
Exercise and Grease Valves		
Test Hi-Level Cutoff on Condensate Tank		
Inspect Metal Coupon in Cooling Water		
Test Natural Gas Meter and Regulator for Operation		
Tanks		
Inspect Tank Foundations		
Inspect Paint		
Inspect Expansion Joints for Leaks or Fatigue		
Exercise and Grease Valves		
Test Bonnhardt Valves		
Inspect Magnetic Liquid Level Gauges		
II PROPANE VAPORIZATION		
Vaporizer		
Test and Lubricate Liquid Meter		
Exercise and Grease Liquid Level Control Regulators		
Exercise and Grease Vapor Regulator (125 psi)		
Exercise and Grease Valves		
Steam System		
Energize Boilers to 13 psi		
Check Fuel System		
Check Burners and Controls		
Test Low Water Shutoff		
Test Flamstrol		
Exercise and Pack Valves		

MONTHLY INSPECTION (CONT'D)

	Observed Setting or Condition	Date Performed
II PROPANE VAPORIZATION (CONT'D)		
Steam System (Cont'd)		
Collect Boiler Water Sample		
Exercise Steam Regulator		
Test Condensate Pumps		
III AIR COMPRESSION		
Check Coil Heaters (Weekly)		
Energize Air Compressors (Weekly)		
Check Cooling System Flow (Weekly)		
Test Cooling Pump (Weekly)		
Check Lubricators (Weekly)		
Test Unloaders (Weekly)		
Inspect Metal Coupon in Cooling Water (Weekly)		
Energize Fin Fans (Weekly)		
Check Coupling (Weekly)		
Check "Mist-O-Pier" for Moisture (Weekly)		
Check Air Regulator at 125 psi (Monthly)		
IV MIXING AND METERING		
Calibrate Thermeter		
Calibrate Calorimizer		
Test Askania Pump (90 psi)		
Test Butterfly Valve Pistons		
Calibrate Pressure Gauge		
Calibrate Orifice Meters		
Test Limit Control Cutoff		
V EMERGENCY EQUIPMENT		
Test Electric Shutdown		
Check All Fire Extinguishers		
VI ELECTRIC		
Test All Station Lighting		
VII PROPERTY AND GROUNDS		
Inspect All Roads		
Report Any Weed Fire Hazard		
Report Any Settlement or Erosion		
VIII MISCELLANEOUS		
Inspect Utility Water Pump		
Check Stack Pilot for Operation		
Check Stack Pilot Lighter Fuel Reservoir		

ANNUAL INSPECTION

PROPANE PLANT

	Observed Setting or Condition	Date Performed
I LIQUOR STORAGE		
Unloading Rack		
Test Unloading Hose, Hydrostatically (100 psi)		
Test Pump Relief Valves (250 psi)		
Clean Pump Strainers		
Tanks		
Check Relief Valves for Leakage		
Test Excess Flow Valves		
Test Bonchardt Valves for Leakage		
Survey Tanks for Settlement		
II PROPANE VAPORIZATION		
Vaporizer		
Test Liquid Check Valve		
Clean Liquid Filter		
Inspect Vaporizer Interior		
Test Relief Valves (250 psi)		
Steam System		
Test Boiler Relief Valves (15 psi)		
Test Mercoid High Pressure Switch (1L psi)		
Clean Steam Traps		
Clean Condensate Tank		
Open Boilers for Tube Inspection		
III AIR COMPRESSION		
Test Pumping Capacity		
Test Interstate Relief Valves (35 psi)		
Test Compressor Discharge Relief Valves (150 psi)		
Check Fin Fan Gear Oil Level		
IV MIXING AND METERING		
Calibrate Recording Thermometer		
V ELECTRIC		
Inspect All Motor Starters		
Inspect All Meters		
Inspect Transformers		

Monthly and annual inspection and maintenance check sheets cover plant from unloading rack to mixing and metering equipment.

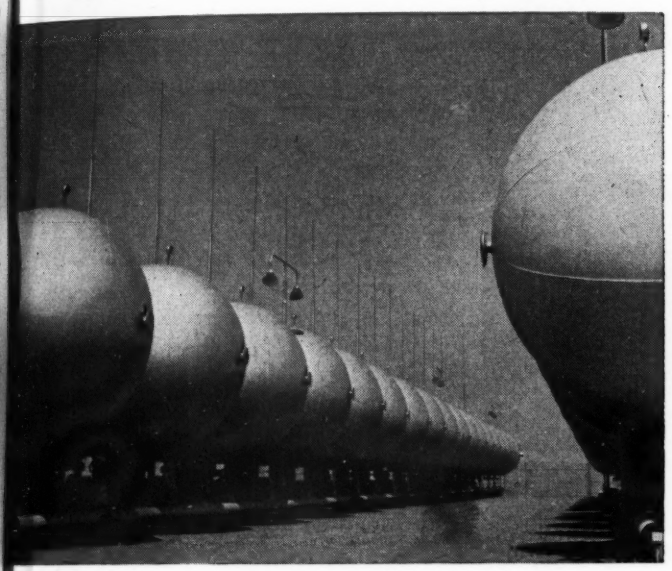


Fig. 2. The 37 steel propane storage tanks (9 ft in diameter and 72 ft long) are interconnected by liquid and vapor lines for liquid transfer or levelling.

on the suction and discharge gauges. Once each year all hose is tested hydrostatically and pump strainers are removed and cleaned.

The vapor compressor is operated to see that automatic oiling devices and the cooling water pump are working properly. The back pressure relief valve is tested by closing the compressor discharge valve and observing the back pressure relief indicator. The meter and regulator through which natural gas flows in emergency to pressurize the storage tanks are tested.

A rigorous monthly inspection is made of the 37 steel propane storage tanks *(Fig. 2)*. Tank foundations are carefully inspected to guard against settling and cracks. Interconnecting liquid and vapor headers are checked to insure that no signs of fatigue are evident in the expansion joints or header loops. The Bonnhardt safety shutoff valves are operated and inspected for leaks *(Fig. 3)*. A Bonnhardt valve is located in the liquid line for each of the tanks. When the system is placed in operation, either as a test or in actual use, the valve is manually opened and held in a cocked position by 75 lb pressure from the natural gas line. This pressure-holding line is terminated in five hand-operated valves located at each of the five exit gates to the storage area *(Fig. 4)*. In an emergency any one of the valves will release the pressure in the line and cause the Bonnhardt safety valve to close, thus closing off the liquid supply from the tanks. Automatic protection against fire is provided by the use of a fusible link in the valve-operating arm between the cocking device and the valve proper.

Since vaporizing the propane is one of the most important operations, great

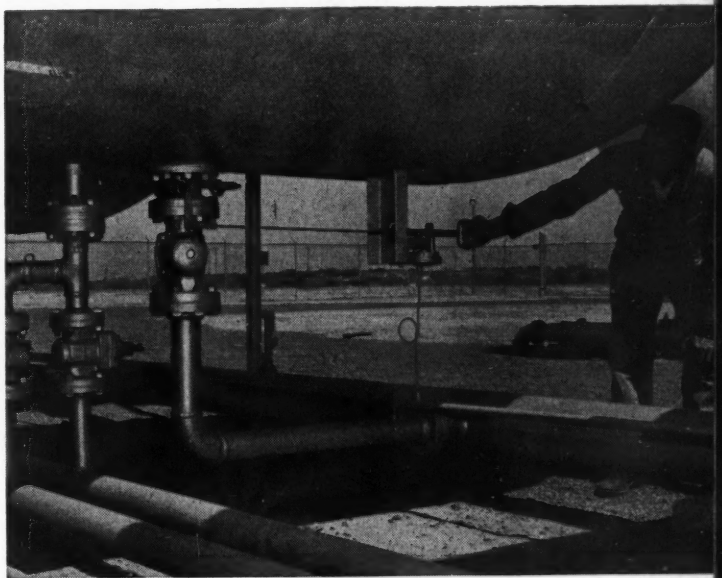


Fig. 3. A. Bonnhardt safety shutoff valve, located in the liquid line of each storage tank is manually cocked and held in an open position by natural gas pressure.

Fig. 4. Pressure holding line is terminated in five hand-operated valves located at each of the five exit gates to the storage area. In an emergency any one of the valves will release the pressure in the line and cause the safety valve to close, thus closing off the liquid supply from the tanks.

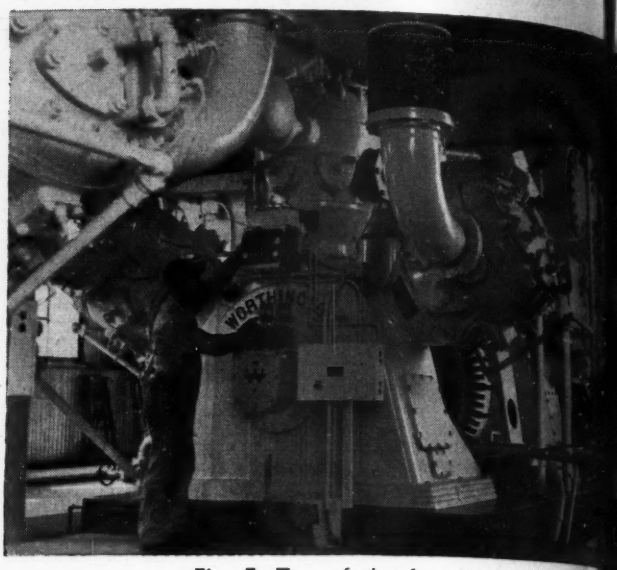


Fig. 5. Two of the four Worthington 2-stage air compressors. The equipment is installed in pairs with each pair driven from an electric motor between them.

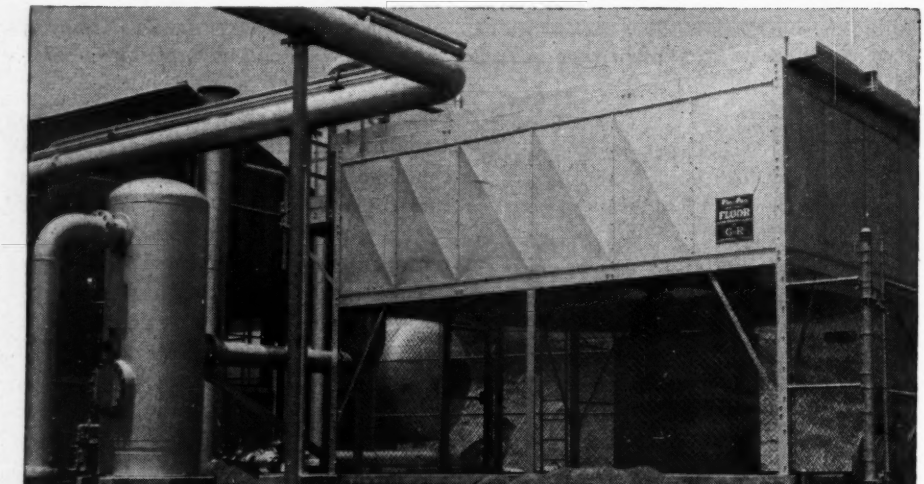


Fig. 6. Compressed air is passed through the Fluor Fin Fan before it is mixed with propane vapor. Compressor building is at left with air surge tank at rear. Vertical tank at left is a scrubber where water is removed from the compressed air.

Fig. 7. The Cutler-Hammer Calorimixer is used to control an Askania regulator unit which maintains a ratio of vapor and air to give a vapor-product of 1500 Btu. The pointer indicates any variation from the heating value for which the equipment has been set. Mr. Engler is shown with the equipment.

care is taken in maintaining this phase of the operation. All valves are exercised monthly and greased when necessary to stop leaks. The liquid level control and vapor regulator are operated and checked for proper settings. Several gallons of liquid propane are run through the liquid meter monthly to test the free operation of the equipment as well as the propane filter. However, when the vaporizer is idle it is emptied of liquid propane to avoid spillage should rupture occur.

The principal concern with respect to boiler maintenance is water conditioning. Monthly checks are made on the pH and hardness to combat internal boiler difficulties. The boilers are energized monthly to check the fuel system, burners and their controls, water level and pressure controls. After steam has been raised to the normal 13 psi, the outlet valve is opened to let steam into the piping. A monthly check of the low water cut-off and Flametrol unit is made. During the winter 5 psi steam pressure is kept in the boilers at all times. In summer the cold boilers are kept at 5 psi with an inert gas such as nitrogen to retard water oxidation that is common in standby boilers.

Air is compressed to 130 psi by four 2-stage compressors and passed through a receiver, an atmosphere cooler, a scrubber, and a pressure-reducing valve to the mixer. At the mixer the pressure is reduced to 125 psi. The air regulator is checked monthly *(Fig. 5)* to insure that it holds this value. Weekly compressor run-ups are made, but when relative

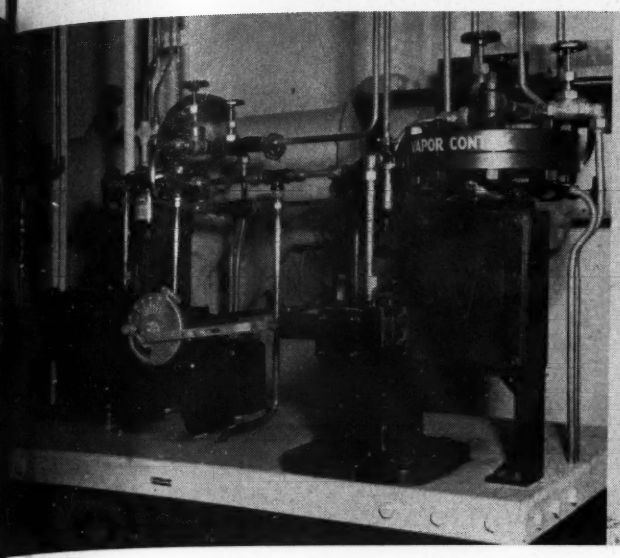


Fig. 8. Askania regulator equipment installed at standby propane-air plant. One regulator maintains an approximate ratio between propane and air over a wide flow range. The other measures propane vapor in response to a Calorimixer reading.

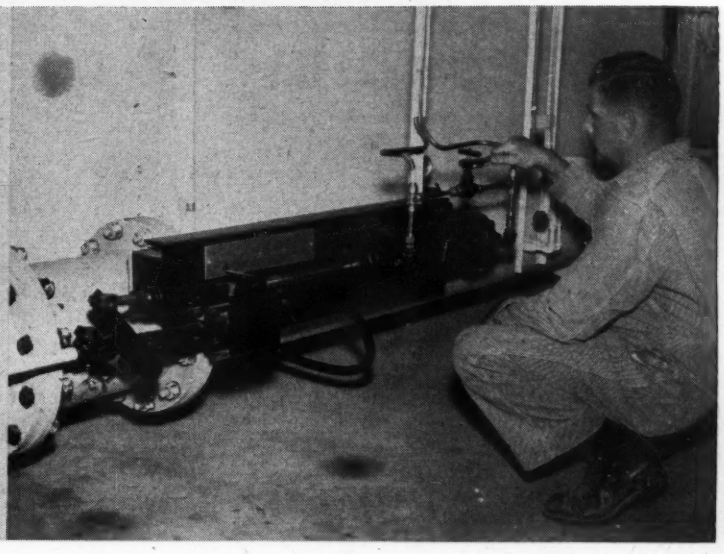


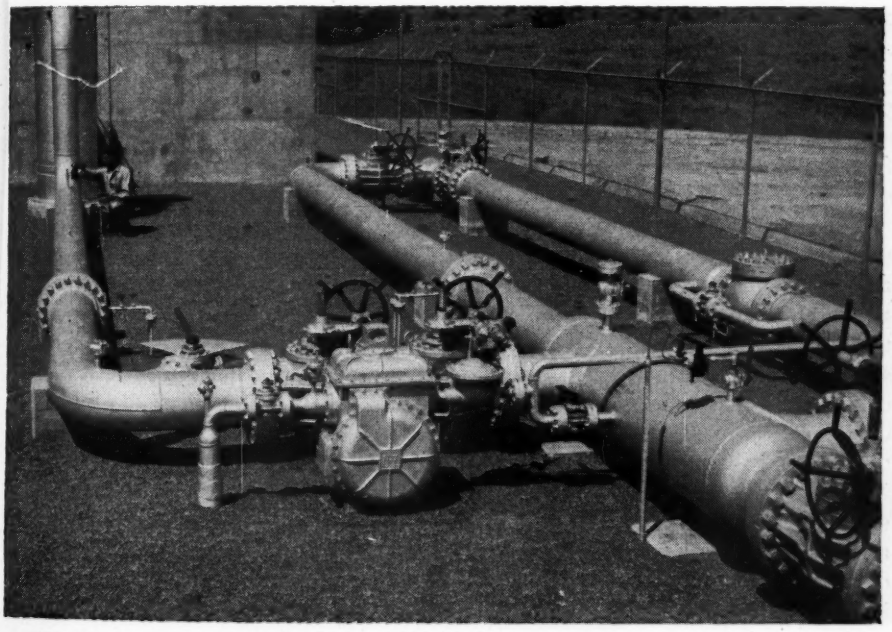
Fig. 9. One of two Cutler-Hammer piston-operated butterfly valves which are controlled by the Askania-Cutler-Hammer calorimetric mixing system. This valve controls the ratio of propane vapor and air to give a vapor product of 1500 Btu.

humidity of the intake air is high the units are run just enough to check the water pump, oil pumps, Fin Fan, and loaders. Annually, a capacity test of the air compressor is made to check valves on both the compressor and receiver. The Fin Fan is checked annually to insure that the gearbox oil level is correct and that the blades are properly balanced *(Fig. 6)*.

The heating value of the propane-air mixture is controlled by an Askania-Cutler-Hammer calorimetric mixing system. The heat content of the mixed gas is continuously measured by the Cutler-Hammer Calorimixer *(Fig. 7)*. This unit resets the Askania regulating system *(Figs. 8 and 9)*, which controls air and propane vapor flows to hold the mixture constant at 1500 Btu. Mixing and metering are probably the most important operations in the entire plant, and the equipment must be maintained in the best possible condition.

The Thermeter *(Fig. 10)* is checked monthly against a constant reference gas. The Calorimixer is balanced to the Thermeter. The Askania equipment does not require frequent calibration; but oil level, pump pressure, cylinders, tubing and valves are checked monthly. Orifice meters and recording gauges are also checked monthly. The recording thermometer is calibrated annually.

Company electricians inspect all electrical units involved in the installation. Motor starters, relays and transformers are checked for grease, oil and signs of wear. Station lighting is checked monthly. General inspection of grounds is also undertaken monthly by the grounds department personnel.



The natural gas and propane-air lines where vapor-air mixture leaves top of mixing tank, left rear, and is applied to two natural gas lines, right, through two Nordstrom valves. Sprague meter, foreground, measures gas used by plant boilers.

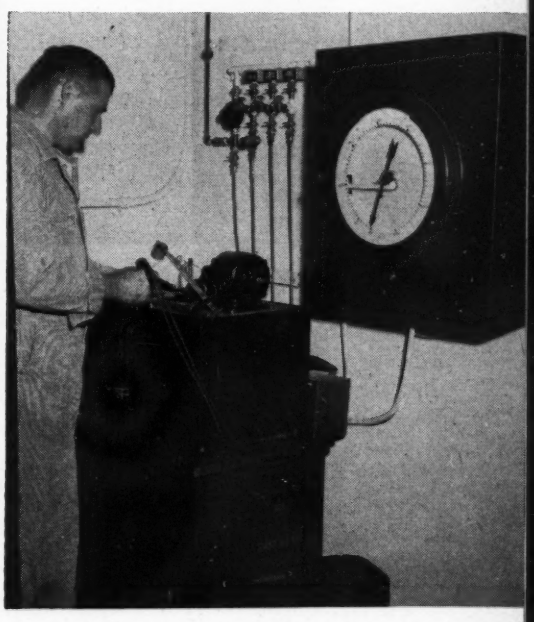
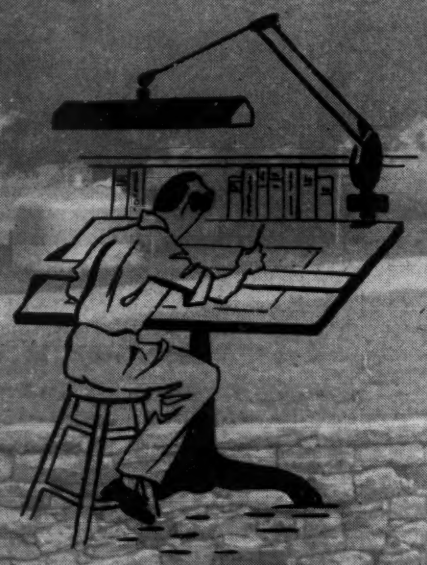
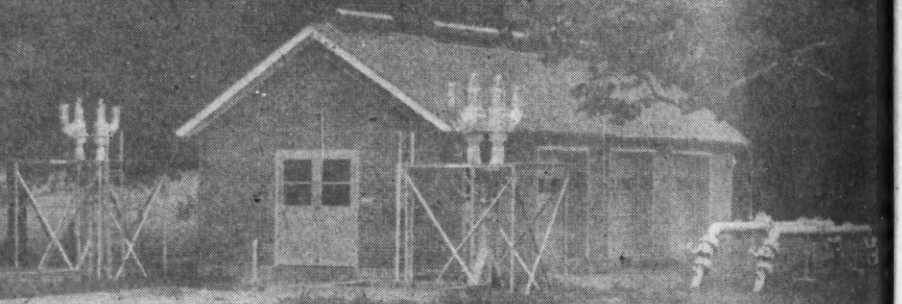


Fig. 10. Cutler-Hammer Thermeter is used to measure and record the Btu rating of the propane air mixture.

Designing a city gate station





This vital link between a transmission system and the distribution network it feeds is an arrangement of meters, valves, regulators, and other instruments of an ever-increasing complexity. Great care must be exercised in selection and assembly for optimum operating efficiency and economy. Even choice of housing structures is an important consideration, and in some cases public relations becomes a basic element of design. In this two-part article, these many facets of overall design are laid out as a guide to the gas engineer.

Chester S. Beard is not only instrument engineer of some note, but he is also a prolific author. This is his third appearance in GAS over a span of three years.

In this two-part work, he calls upon his long experience in the design field to develop the various considerations involved in building a city gate station. These considerations range from a choice of site and housing to the selection and application of instrumentation.

In August, Mr. Beard joined Foster Engineering Co., Union, N. J., as research and development engineer, having left Ebasco Services Inc., where he participated in the planning of numerous gas installations.

By C. S. BEARD

"CITY GATE STATION" is a fitting name for the station through which gas must pass to enter the limits of a city, town or large consumer's property. One basic function of a city gate station is to measure the heat units being delivered; this function is performed by determining the volume and heat control of the gas. Another function is to reduce or regulate pressure.

This first function of primary measurement requires records or periodic tests of specific gravity, temperature and pressure. With these, the volume measurement may be corrected to an accepted standard set of conditions. Adequate checks must be made of heat content, deviation from Boyle's law, moisture content, and chemical purity. In designing a city gate station, basic considerations are the equipment available to make these determinations and the manner in which the equipment may be utilized at one location.

Many varieties of conditions or relations exist between the company transporting gas from the oil-gas fields and its customers. The transmission company may be selling gas directly to a large consumer such as a utility company for use in a steam-electric plant. Under these conditions the transmission company will establish a city gate station to deliver gas under the conditions of the contract. The company transporting gas from the fields may sell gas to a second transmission company serving towns along a transmission line which is a lateral or offshoot of the supplying line. The first company establishes a meter and regulating station to satisfy the conditions of its contract; this, despite its location, we term a "city gate station." The second transmission company must establish city gate stations to supply gas, in wholesale quantities, to its customers. A third condition arises when a utility company receives gas from the transmission company at one point and desires to deliver this gas to different points in its own systems. In many cases a city gate station is desirable at each point of delivery as the different parts of the system may be isolated from each other and gas delivered to each at a different pressure.

SELECTION OF SITE

Selection of the location of a city gate station requires consideration of:

Accessibility for maintenance and service.

Adherence to local restrictions.

Consideration of "where is the town going?"

Accessibility

Accessibility is important, as a large percentage of the city gate stations of the country are unattended and require operating personnel only to change charts, make adjustments, or service equipment. Relatively few stations warrant continuous attendance.* Ideal accessibility of unattended stations is obtained when the city gate station is located at a gas generating station, repair depot yard, or other existing facility, but this is not always possible because of restrictions in transmission pressure imposed by city ordinance. In this latter case, pressure regulation outside the area covered by the ordinance will be required. When the equipment is called upon to accomplish this major function, it is usually advisable and economical to include the other functions of the city gas station at the same location.

Normal procedure places ownership of a large share of the lateral line from the transmission line to the town, or point of use, in the hands of the purchaser. Placing the sales meter and regulating station close to the transmission line allows for measurement of all gas including leakage, and thus places the responsibility on the purchaser where it rightfully belongs. At least one transmission company took a realistic view of one of its installations. The purchaser used the gas in a steam-electric station about two miles from the tie-in point. The line, which is of welded construction, is of fairly small diameter, with no take-offs between the plant and tie-in. The entire installation is far from the transmission company's service personnel. The transmission company installed the meter and regulating station on the utility company property so that the plant employees change charts and, upon instruction of the gas dispatcher, make operational changes in regulator settings.

Consideration of accessibility must go further than the mere selection of a site that is as close as possible to available personnel. For one thing, it is important to caution the designer to select a spot which may be reached in all kinds of weather and under all conditions. Due consideration must be given to drainage, wind conditions (particularly when telemetric controls are used), possible flooding, landslides, road conditions, and hostile neighbors. The threat to service operations of hostile neighbors cannot be overemphasized. Although it is impossible to guard completely against the ravages of storm, it is possible to select a location which is least liable to be affected.

*The 134th St. station through which Transcontinental Gas Pipe Line Co. furnishes gas to Consolidated Edison of New York and the Spence St. station of Southern California Gas are examples of stations which justify having an operator on duty at all times.

Adherence to local restrictions

The industry has, through the piping code (ASA B31.1), made its own ordinance requiring additional pipe-wall thickness for populated areas. However, many communities are beginning to consider passing ordinances which would practically prohibit the transporting of gas above 100 lb through cities to distribution points. An engineering analysis would show that these requirements include abnormally high safety factors. In selecting a city gate station location it is necessary to plan for the possibility of unreasonable ordinances. This entails the balancing of the difficulties and costs of servicing stations at remote locations against the economic considerations of large low pressure lines vs. small heavy wall pipes.

Many communities do not prohibit a meter station in a residential area but require that the station conform to the building ordinances of the zone. Even where no such ordinances exist, it is necessary to maintain satisfactory customer relations. Numerous designs for making stations of various sizes inconspicuous were shown in the article, "Camouflaged Stations Keep Denverites Happy," by Robert H. Taylor and A. M. Christensen, which appeared in *GAS* in April 1951 (pages 49-51). The city gate station is larger than most distribution regulator stations so it presents a greater challenge to the imagination of the designer. Various approaches to the problem are discussed later under "Houses."

Where is the town going?

Oddly enough, the location of the city gate station depends to a great extent upon the route of the lateral gas line. The gas line must tie in to the existing system at a point from which intermediate or low pressure gas can reach all sections in adequate volumes. Location of the city gate station may be at this point, but the final decision would be influenced by the possibility of keeping present or future neighbors happy. Furthermore, it would be inadvisable to select this point if a growth survey shows that the expansion of the city would require additional tie-in points between this station and the transmission line.

Fig. 1. Individual meter house offers adequate protection for many installations.

Gordon Z. Greene Co.

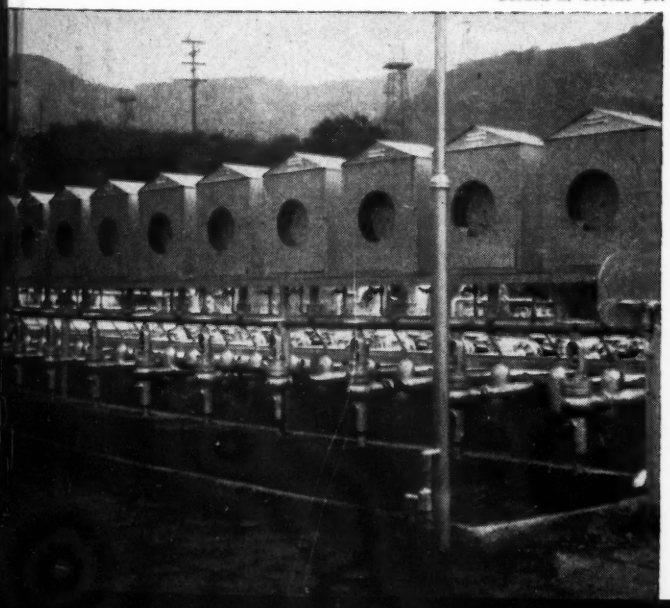
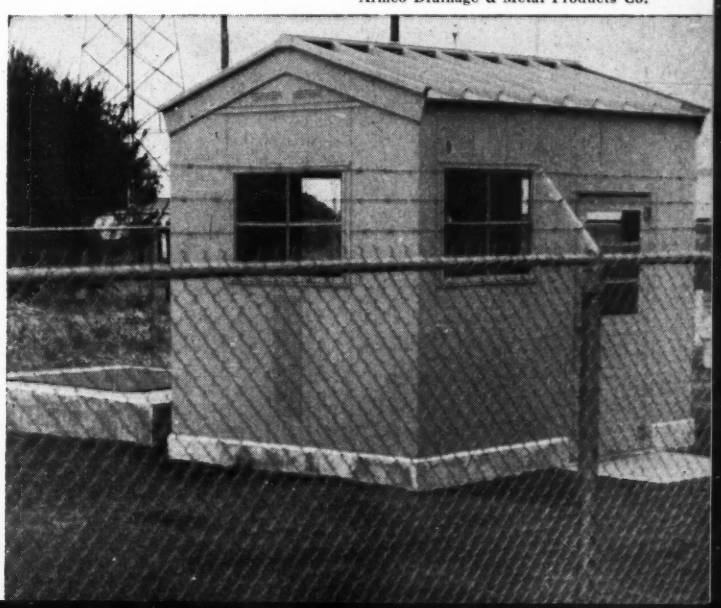
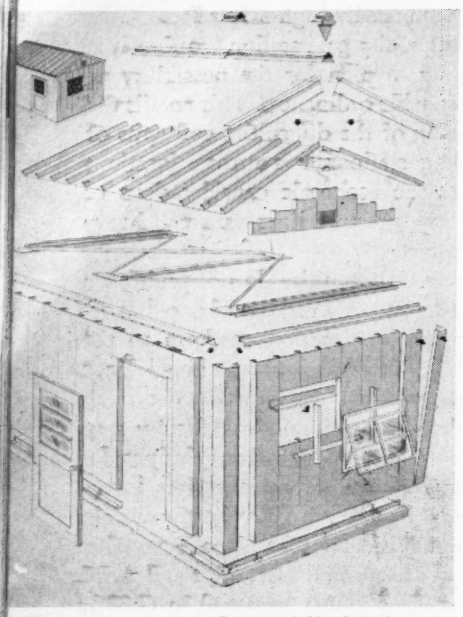


Fig. 2. Prefabricated metal buildings are attractive and practical.

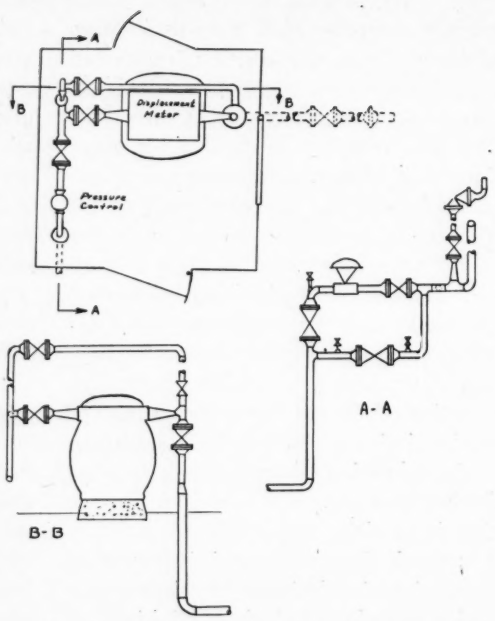
Armco Drainage & Metal Products Co.





Armco Drainage & Metal Products Co.

Fig. 3. Construction features of the prefabricated building.



Ebasco Services Inc.

Fig. 4. Compact installation design for large capacity displacement meter and regulator may be housed in small prefab house.

HOUSING AND LANDSCAPING

Housing is done for four reasons: to protect equipment, to provide camouflage, to abate noise, and to allow maintenance under adverse weather conditions.

Housing facilities are available in many forms and sizes. Individual meter houses *(Fig. 1)* although primarily used for electric telemetering transmitters, have many other applications. These houses are individually mounted for complete dissipation of any gas leakage which might otherwise be ignited by the electrical contacts.

Prefabricated houses of the type in *Fig. 2* are available in all shapes and forms.

Selecting a prefab

In selecting a prefabricated building it is wise to consider the equipment offered from various angles. The material must be prepared or coated to withstand weather and local atmospheric vapor conditions. The structure must be designed to withstand wind, rain, and ambient temperatures without losing its weatherproof qualities. Doors, windows and ventilator sections must remain tight and plumb through heavy winds and widely varying temperatures. The design must be such that full advantage may be taken of the prefabrication feature, which allows for expanding or moving the structure. The expanded detail, *Fig. 3*, shows how these requirements have been satisfied in one commercially available building. The correctly manufactured prefabricated building may be insulated for noise control or weather protection, with the insulation installed as rigid board with an air space between the board and the outside wall. Blanket insulation may be laid into the wall sections or the space between an inner wallboard, and the outer wall filled with insulation by the blowing method.

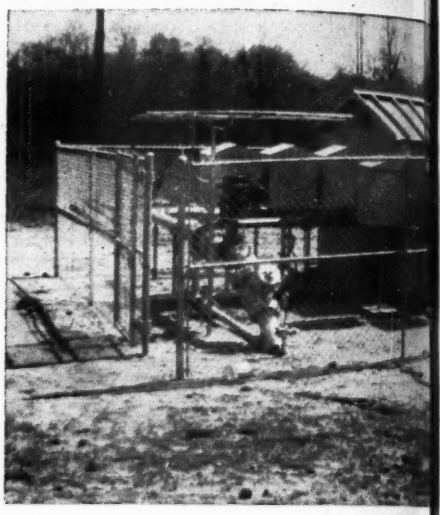
All meter houses should be provided with two doors placed for emergency exit. Placement of windows and doors is flexible. Doors are available with louvers and various types of ceiling ventilators are provided. A 4-in. concrete pad laid on 6 in. of crushed rock is sufficient to support all metering and regulating equipment. Additional foundation support may be supplied for heavier apparatus used for fogging or odorizing.

Corrugated sheet steel houses and three sided shacks are in common use in localities where appearance is not a vital factor. Brick buildings are used extensively while stucco buildings are not as common.

Protection of equipment

Design of city gate stations runs the gamut from complete exposure of equipment to complete cover. Regulators and metering equipment are built to withstand a large amount of abuse from the elements. Sometimes the tendency is to think in terms of the comforts of station personnel rather than the protection of the equipment. Although many attractive and well designed stations are completely under cover this is an unnecessary expense under climatic conditions prevailing throughout much of the United States. On the other hand the house required for a station consisting of regulator and displacement meter *(Fig. 4)* is about as small as can be constructed or purchased, so there is no extravagance in having complete housing.

Central operating panels, which are becoming popular even in small orifice meter stations, should be placed under cover. One of the smallest prefabricated houses available will enclose a panel board, two orifice fittings or sets of flanges, one differential trip valve, and



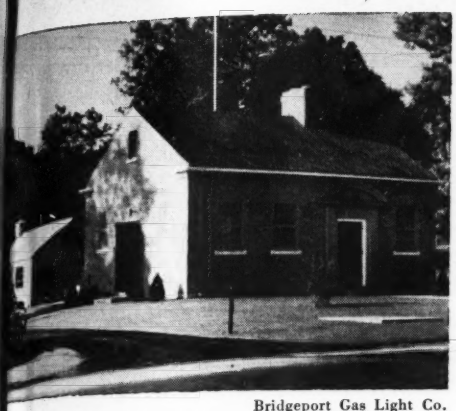
Jersey Central Power & Light Co.

Fig. 5. Two orifice fittings, trip valve, temperature points and instrument housed in an 8 x 8 building.

prescribed thermowells and sampling connections. Each additional meter run will require about 8x6 ft more area of coverage *(Fig. 5)*. If enlargement is foreseen, the house should be installed so that a section may be added to the end.

Indoors or out?

Heated arguments may occur over whether control valves and regulators should be located indoors or outdoors. Although the field engineer will accuse the design man of never having had to work on a regulator in the snow, rain or heat, the evidence shows that normal adjustments can and are made in desert heat and freezing cold. Fortunately, the quality of present day regulating equipment has improved so that maintenance is decreasing, and the feeling is growing that many of the large buildings used for



Bridgeport Gas Light Co.

Fig. 6. What—A meter house?

city gate stations are unnecessary and more hazardous than small houses selected for more delicate recorders and controllers.

Necessity for blending with the type of buildings in the neighborhood will in many cases require housing most of the equipment. This does not necessarily mean that it must be camouflaged to look like a dwelling. The station shown in *Fig. 6* is a fitting addition to any neighborhood. Small stations may be completely absorbed as a part of a house *(Fig. 7)* and as one side of a garage *(Fig. 8)*.

Housing metering and regulating equipment is one approach to noise abatement. Numerous types of insulation have been employed with various degrees of success. This is surely not the final answer to the noise problem but a recent sound survey on one of the largest stations in the East showed that a large portion of the noise, particularly in the low frequencies, is eliminated with a sheet steel building. A brick building is quite effective in decreasing noise. Noise is an irritation which is difficult to foresee so it is hard to determine before the station is in operation what refinements must be made and how much should be spent on housing for noise abatement alone. A discussion of piping design features which are most likely to produce a quiet station is included in this article.

Fencing

Fencing is a necessity for unattended outdoor stations because so much depends upon proper and continuous operation of the station. Steel fencing at least 6 ft high of the type similar to that shown in *Fig. 2* is recommended. Other styles of fence may be adequate to keep the animals out, but the major menace to safe and continuous operation is the inquisitive two-legged animal. Special cases may require ornamental fencing. Emergency exit from the station area is improved by the use of two gates, always of the swing-out type. In the case of large stations or those of adequate surrounding area, one of these gates should be a truck entrance. A pedestrian gate adjacent to the truck gate defeats the emergency consideration. A little thought given to layout of equipment in relation to the truck gate will save many foot-pounds of energy when equipment changes are made.

Landscaping

Green grass and flowers are very nice if there is an operator on duty or a well defined program of gardening is established. Otherwise, concrete, crushed rock, or oiled sand will make a much better impression than an unkempt lawn and weedy flower beds.

Retaining walls such as the one in *Fig. 5* and the very attractive stone wall in *Fig. 9* are necessary adjuncts. Above-ground meter run and regulator installations usually require bypasses or shut-off valves close to the graded level of the station area. The effect of heavy rains or shifting excavations must be foreseen and retaining walls or drainage ditches provided to guard against making these valves and bypasses inoperative.

Public Service Co. of Colorado.

Fig. 7. Believe it or not, a small meter station is housed in part of this building.

Fig. 8. Part of this garage is a station.

Public Service Co. of Colorado.

Fig. 9. The wall of this picturesque station is attractive as well as utilitarian.

Nashville Gas Co.

EQUIPMENT PLACEMENT

In most cases the plot of ground to be used for a city gate station must be purchased. For this reason it is economical to place equipment in a compact arrangement, although it should never be crowded. *Fig. 5* shows a station that is compact yet allows ample room for work on any piece of equipment.

Shape and size of the plot of ground available may not be a matter of choice but of exigency. If only a long, narrow plot is available the station must be designed for this area. Our somewhat odd desire for symmetry makes it difficult to adapt a station to other than rectangular plots of ground. Many engineers seem to have a prejudice against running diagonal lines even when they are underground and out of sight. Visible lines which run in odd directions do not contribute to a "ship-shape" design but it seems unreasonable not to take advantage of this useful means of getting from one point to another when the lines are buried. Use of oblique angles will minimize pressure drop and noise.

Symmetry

Practically complete symmetry has been obtained in the station shown in *Fig. 10,* where area was not an item of consideration as the station is on a large piece of property owned by the gas company. Having the regulator horizontal approaches as long as the meter runs gave this symmetry.

However, design of a meter station can be pleasing to the eye without being symmetrical. In most cases the station with the least acute angles in the piping, which should be the most silent style, cannot be designed with balanced placement of equipment. It is more important to eliminate an excessive number of direction changes than to produce a symmetrical station.

Compact design is the subject of continuing study. The layout of a standardized design has been developed by Transcontinental Gas Pipe Line Co. This design minimizes length by reversing flow from the meter run header to a vertical header. This header feeds the regulators which discharge to another header, which in turn connects with the station discharge line. This piping may be moved from one location to another much more readily than most stations. The area between the meter runs is utilized for mounting meters and recorders. It is the practice of Transcontinental Gas Pipe Line Co. to house the entire assembly.

Pipe, meter run, and regulator sizes are the controlling factors in the area required, no matter what design is used. Considerations for meter run and regulator sizing will be discussed later. Under most conditions full consideration must be given to expansion, whether it be by enlarging equipment or by additional facilities. One advantage claimed for for Transco design is the ease with which one assembly may be removed and another installed or an existing assembly paralleled by another similar setup. The Transco station design has unlimited possibilities for expansion of measurement and control equipment. Limited expansion is possible in the existing meter house while further enlargement would require inexpensive additions to the prefabricated house.

PIPE AND FITTINGS

Steel has become virtually standard for city gate stations, Although thin-wall pipe would be adequate for gas pressures required in many stations, particularly on the reduced pressure side of the regulators, most of the pipe is schedule 40. Schedule 60 is used for pressures over 600 psig for pipe up to 24 in. In pipeline work, savings of thousands of tons of steel and millions of dollars may be realized by telescoping or using the wall thickness for the maximum pressure in a particular section of pipe. This is not the case in station construction. The comparative ease of obtaining schedule 40 pipe and relative difficulty in securing fittings suitable for welding to thin-wall pipe have led to this use of schedule 40 pipe.

Considerable saving may be made by using valves rated for the reduced pressure (schedule 15) when no more than a maximum pressure is guaranteed by the use of relief valves. This saving is nullified if the relief valves are installed for protection of the station when they are not required to restrict the pressure of the system into which the gas is being delivered. Some companies will not use any series 15 fittings in order to protect themselves from inadvertently using reclaimed low pressure fittings on a future high pressure service.

Use welded connections

Fabrication of city gate stations is accomplished by using welded connections as much as possible. The practice of using screwed fittings for sizes up to 2-in. has been discarded by many designers. Even ½-in. pipe is being welded either by butt welding or by using socket-weld fittings. Some companies will use screwed fittings but back-weld the threads. Flanges are used only at points which facilitate the removal of equipment such as control valves and meter runs. Plug cocks of various designs figure prominently in station construction.

Welding fittings and weld-end valves are purchased with the ends prepared for butt welding. Small sized fittings may be supplied for socket-weld design. The use of accepted welding techniques with these fittings gives connection which will more than satisfy the pressure specifications of the system. Use of existing fittings with higher pressure ratings may require transition pieces with each end especially prepared to fit.

Branch lines must be welded in most header construction *(Fig 11)*, and this requires further consideration. The American Standard Code for Pressure Piping ASA B31.1-1951 states conditions under which this branch line must be reinforced. By interpretation of the code or use of charts,* a minimum S value (allowable stress), may be deter-

Fig. 10. Symmetry in layout is represented by the Knoxville station of East Tennessee.

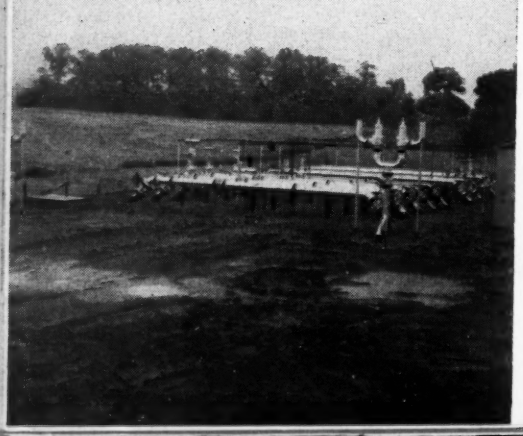
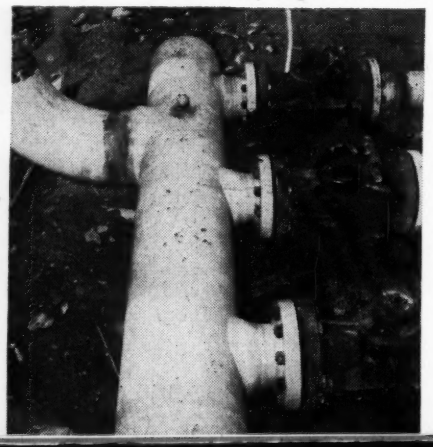
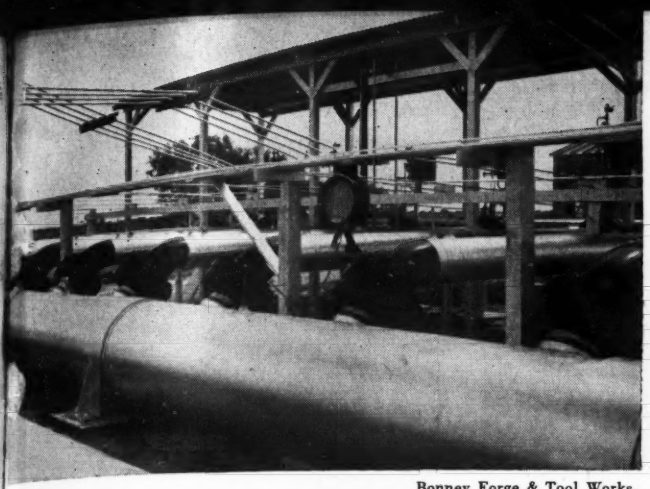


Fig. 11. Manifold construction using large-sized Weldolets.

Bonney Forge & Tool Works.



*Bonney Forge & Tool Works.



Bonney Forge & Tool Works.

Fig. 12. Weldolets used at Refugio project of AGA-ASME orifice meters subcommittee.

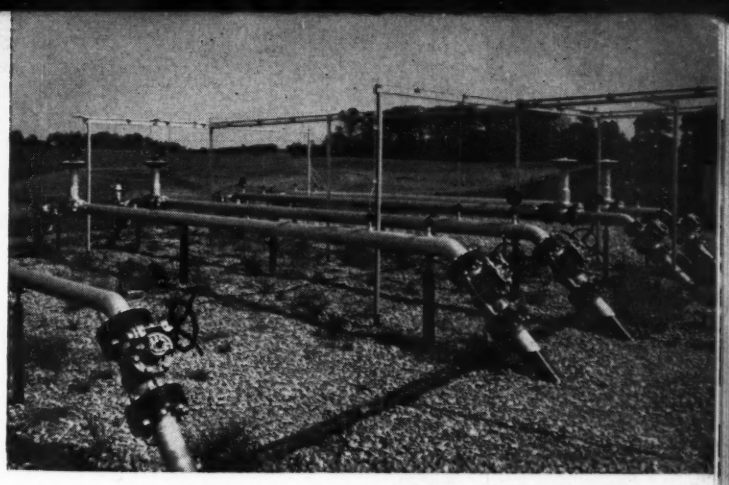


Fig. 13. Neat instrument piping installed rapidly, using Unistrut.

mined. Reinforcement is necessary if the S value of the pipe is below this value. Bonney Forge & Tool Works has developed a very simple and usable method of determining the conditions under which reinforcing is necessary. This method will appear in literature and be available in the near future.

What is reinforcement?

The next question which presents itself is: What constitutes reinforcement? The code committee is considering this question. Reinforcing is accomplished by using an additional pad welded to the header which is a collar for the branch line. Welding outlet fittings are available which satisfy the requirements of reinforcing. These are shown in *Fig. 12* as used in the Joint AGA-ASME orifice meter subcommittee installation at Refugio, Texas, and in a typical header application *(Fig. 11)*. These fittings offer protection for additional stresses caused by vibration, weight expansion and contraction, and corrosion. Welding neck flanges are welded directly to the outlet of the fittings. Use of the fitting becomes economical on the basis of ease of welding and line-up.

Vibration, like so many other undesirable conditions, should be eliminated at the source rather than compensated for by methods devised on the spot. Vibration caused by trains or some other activity not connected with the gas system may often be foreseen and another site selected. Vibration caused by the cycle of compressors or high frequency pulsation in a regulator should be remedied at the equipment. Unavoidable vibration of the piping may be eliminated by tying it down to supporting piers. Underground headers may eliminate a large portion of the vibration whether or not the header rests on a concrete pad.

The relief valve installation frequently consists of a single riser branching to two valves with a blowoff line from each valve. This system must be adequately based, supported, and braced. Vibration of recording instruments causes a wide line on the chart. A minimum of difficulty occurs when the individual instrument is mounted on a pipe stand embedded in concrete rather than on a saddle on the line piping. An instrument board based on a floor isolated from other foundations is less liable to vibrate than when it is mounted on a large pad which is the base for all piping and equipment.

Lengths of piping in most stations are not long enough to cause excessive stresses from thermal expansion or contraction. The effect of expansion or contraction of the mainline upon the station piping should not be neglected, but most stations contain sufficient flexibility to take care of these movements. In many cases the inlet and outlet of the station are at an angle to each other so that movement may be absorbed. Considerable movement of a mainline could occur if a section of the mainline was taken out, laterals connected to the open ends, and the station built between the laterals. This movement would be stabilized if the section were to be left in for bypassing and laterals taken off as taps from the mainline.

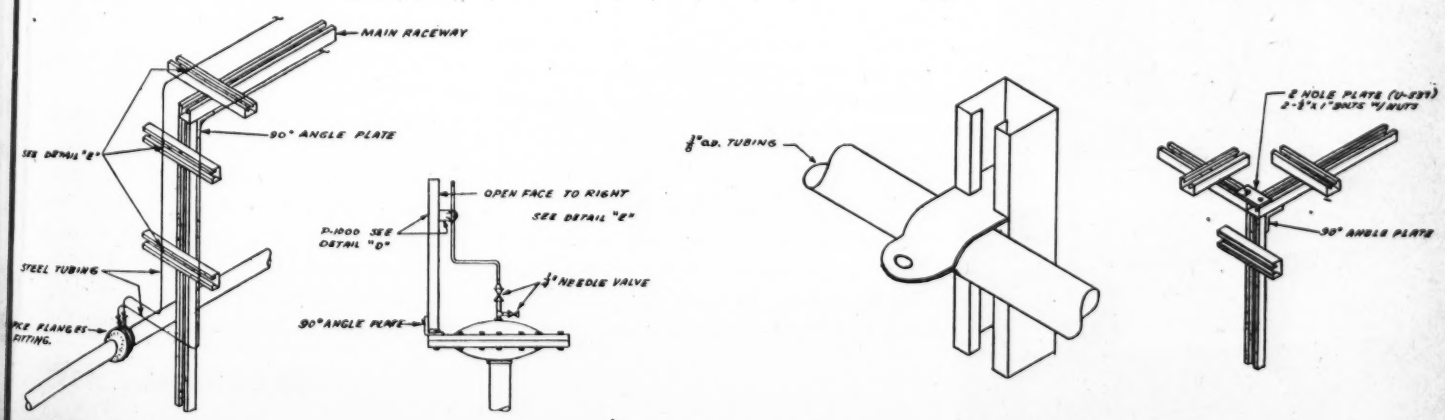
Piping materials

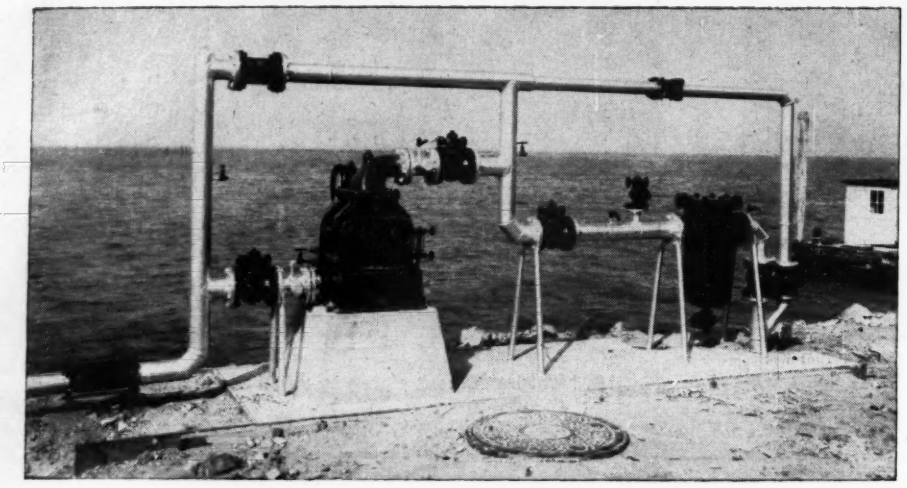
Instrument piping may be steel, copper, or aluminum tubing. The trend is toward soft annealed steel tubing. Although this tubing is a little more difficult to work than half-hard copper, its resistance to a flash fire and rupture caused by careless personnel is in its favor. All of the standard designs of tubing fittings will give good service if installed carefully. Tubing should be installed with a minimum of couplings.

Various methods of supporting the tubing have been used. *Figs. 13* and *22*

Fig. 14. Methods of using standard fittings for instrument piping supports.

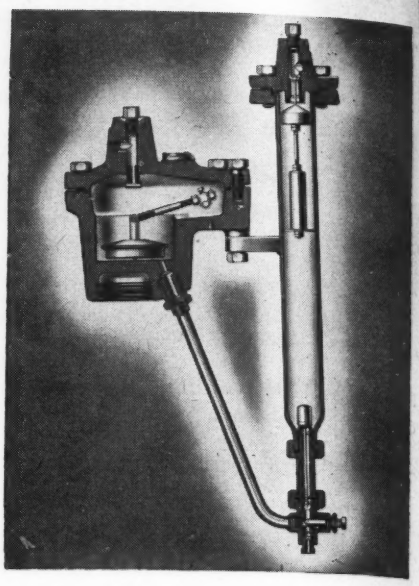
Ebasco Services Inc.





Roots-Connersville Blower Div.

Fig. 15. Rotary displacement meter has high capacity.



American Meter Co.

Fig. 16. A familiar friend of the gas measurement engineer.

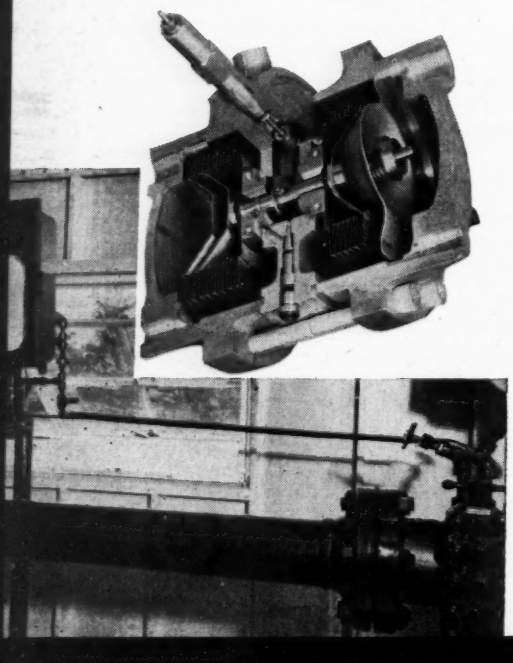
show the use of a commercial product normally used for conduit support and storehouse racks. As is evident in the pictures, the equipment adapts itself nicely to this use. *Fig. 14* shows methods of applying standard parts to this use. A prefabricated open mesh trough is available in 3-in. to 24-in. widths. So-called fittings such as ells, crosses, tees, riser elbows, blind ends, and drop-outs are furnished so that it is unnecessary for a welder to be occupied with the field construction of troughs.

Gone are the days of drilling and tapping a mainline for a static connection. Bosses, half couplings, and Weldolets are normally used for all connections to the line. The use of a ¾-in. socket-weld Weldolet, ¾- to ½-swaged nipple and a 2000-lb gauge cock will economically satisfy strict specifications. In many cases the cock may be used with a ¼-in. female thread in the discharge for direct connection to tubing fittings.

Installation of test connections on equipment must not be neglected. A connection either with a valve or plug should be provided in the line to the pressure pen of the flow meter for checking against a test gauge or dead weight tester. A shutoff valve and bleed valve should be installed at the valve actuator in the air supply line from a controller so that the valve may be held at a given opening by locking in the supply pressure. Other such connections will become evident when the installation design is studied through the eyes of the instrument repairman.

Fig. 17. Use of the bellows meter body is becoming popular in gas measurement field.

Barton Instrument Co.



Corrosion protection

Underground pipe must be protected. When the meter station is installed while pipeline work is going on, the same equipment for coating the line may be used for any pieces which may be handled by the equipment. The various sizes of pipe and irregularities in placement of station design preclude quantity coating as is done with line pipe. Various tapes have been found to be adequately protective and economical if carefully applied. Insulating flanges are used to electrically isolate the branch line and the station from a transmission line. The station may be included in the cathodic protection system of the branch, or may be isolated by another insulating flange at the discharge of the station and separately protected.

GAS MEASUREMENT

Gas is measured by using a displacement or an orifice meter. Selection of the equipment depends upon maximum and minimum flow rates and may require both types of meters in the same station. The use of a displacement meter in parallel with one or more orifice meters, or two or more orifice meters in parallel, has been accomplished by the use of a differential trip valve. This is a control system in which a valve is opened to operate another meter run as the capacity of the first run or displacement meter is reached. This equipment will be discussed later.

Displacement meters of the diaphragm type will handle rates up to approximately 60 Mcf/hr. The rotary meter shown in *Fig. 15* will measure up to 500 Mcf/hr. The displacement meter must be used in conjunction with an orifice meter when the flow rates occurring during the night or on Sunday are very low in comparison to the normal rate. This may occur, for example, at a station furnishing gas to a manufacturing plant which is shut down for one or more shifts or a small town in which the night load consists of only pilot lights. The minimum rate of flow must be very low and the ratio of minimum to maximum very high to warrant the use of a displacement meter because the range of an orifice meter can be made about 10 to 1 by using a high-and-low differential range instrument.

Measurement of the differential across an orifice for purposes of determining the volume of gas delivered is accomplished with a mercury manometer instrument *(Fig. 16)*. Although instruments employing a diaphragm, bellows and electric transducers are available for this application, these are not in common

use in city gate stations. Very few sales of gas are made on the basis of charts on the receiver of a pneumatic transmission system. The future will probably see the use of these newer approaches which have already been accepted for critical services in refineries and plant operations. The bellows meter *(Fig. 17)* has passed rigid operational and calibration tests and is found to have decidedly less zero shift due to ambient changes.

General knowledge of calibrating techniques and the desire for simplicity and standardization have caused continued use of the mercury manometer body which responds to differential pressures and causes a pen or pointer movement relative to the existing differential value. Very accurate manometer bodies are available which extract the square root of the differential so that movement of the pointer is uniform. This means that the distance between the square root of one and the square root of four on the chart will be the same, for example, as the distance between the square root of eight and the square root of nine. This is accomplished by shaping the chamber and the float and using electric probes, or by the shape of the cam of certain makes of electric or pneumatic transmitters. This type of manometer, capable of extracting the square root, has not enjoyed significant acceptance as a gas sales meter.

Chart changes

Most large stations use 24-hour chart records. Isolated stations sometimes use 7-day charts. Eight-day charts are now being used also so that the chart is changed only four times per month.

Square root charts make it possible to read the square root of the existing differential directly from the chart. The position of the pen recording absolute pressure on the line will be relative to the square root of this static pressure. Application of the correct factor to the orifice coefficient makes it very simple to obtain instantaneous or average rate of flow. The rate is the coefficient x static reading x differential reading. The use of this square root chart seems to be standard in some parts of the country while the uniform chart showing readings of differential in inches and static in pounds is standard in other localities. The precedent set by the transmission company seems to set the pattern for areas receiving gas for the first time.

The basic design of the mercury type differential gauge has changed very little in the past 15 years. Many refinements have improved the equipment for accuracy, decreased maintenance, and wide application. The advent of Teflon bearings and silicone lubricants and the ability to machine smoother surfaces has greatly decreased friction difficulties in the shaft from the manometer float to the pen arm. Accuracy has been improved by decreasing the possibility of leakage through this bearing. The manometer bodies are now constructed so that change of range is easily accomplished. Check valves have been improved so that over-range or reversal will not blow the mercury. Easily adjustable pulsation dampeners are standard parts of present-day orifice meters. Along with these refinements have come many details which collectively contribute to continuous use with a minimum of maintenance.

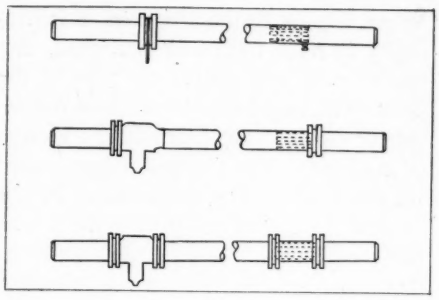


Fig. 18. Component parts of the meter run may be assembled in various ways.

Continual research by societies such as SCMA*, PCGA, AGA, and ASME has brought about specifications for meter runs which will, if followed, make it possible to measure gas very accurately. The meter run, which consists of the approach tube, straightening vanes (optional), the orifice plate with suitable flanges or fittings, the downstream section, and necessary taps and thermowells, is responsible for creating a differential pressure under conditions which were used in developing the flow formula. Any deviation from published standards contributes to indeterminate variations in the measurement.

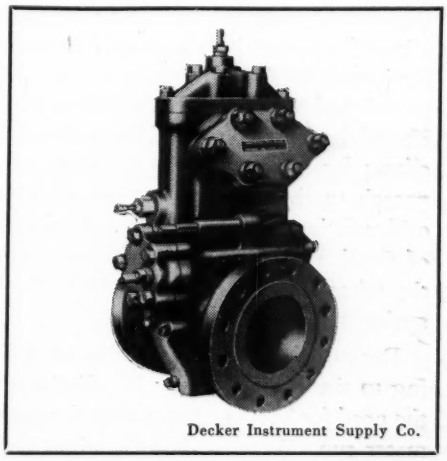
Numerous fine articles have been written covering in detail the construction of meter runs. Nevertheless, a few remarks are pertinent to this study. Quoting from an accepted orifice meter procedure: "The sections of pipe to which the orifice flanges or orifice fittings are attached, or the sections adjacent to the orifice flange or fitting, shall be as nearly cylindrical, smooth, and free from blisters and scale as can be obtained commercially."

Measuring diameter

In satisfying this requirement for cylindrical pipe, it is common practice to make four diameter measurements at each of three places in the tube. Four measurements 45° apart are taken at points which are 1 in. from the end of the pipe, and also one-half the bore diameter from the end. The difference between the maximum and the minimum observed diameter should not exceed the accepted tolerances. Although the accepted deviation is greater for small Beta (diameter of orifice to diameter of pipe) ratio, it is advisable to always use the tolerances for the greatest ratio. This deviation for the

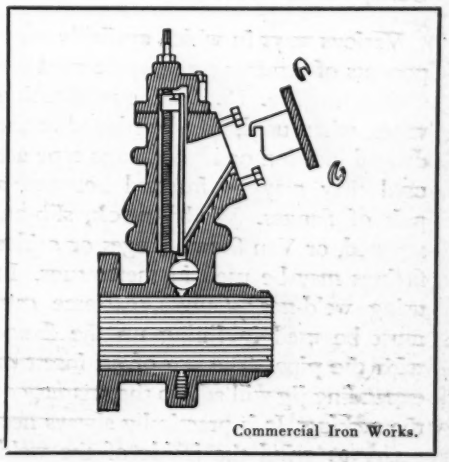
*Southern California Meter Assn.

Fig. 19. Typical CN orifice fitting which can be inspected without shutdown or bypass.



Decker Instrument Supply Co.

Fig. 20. Orifice fitting similar to that shown in Fig. 19 may be installed with a welding neck on the approach end and a flange on the discharge end.



Commercial Iron Works.

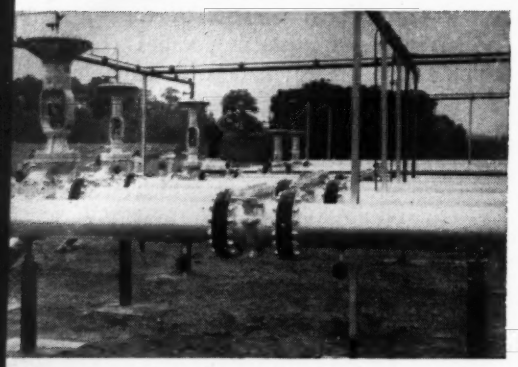


Fig. 21. Orifice fitting which allows quick change but requires shutting down the meter run.

When slip-on flanges are used, it is necessary to back weld and face weld. Excessive heat will distort the pipe at the back weld, requiring grinding of the inside of the run. The face must be ground or machined. The screwed flange is used on small sizes. The thread must be cut so that the end of the pipe is flush with the face of the flange. The Van Stone flange requires the same care in assembly, depending upon the method in attaching the lip of the flange assembly to the meter run. Orifice flanges are rated schedule 300 or higher. The thickness of the schedule 300 flange is required to accommodate the drilling for the static

change of orifice plates are accomplished by using the orifice fitting. Yearly inspection of the meter run is made possible by bypassing the entire station. An orifice plate, between flanges, may be left in the bypass for measuring flow during the annual inspection. This, in most cases, is not necessary as the inspection may be scheduled at a period of low or fairly constant load conditions.

Most large stations must handle a very wide range of flow rates. The displacement meter is used up to 60 Mcf/hr. The next step in obtaining capacity is to use another displacement meter. This is seldom done; instead, an orifice meter is

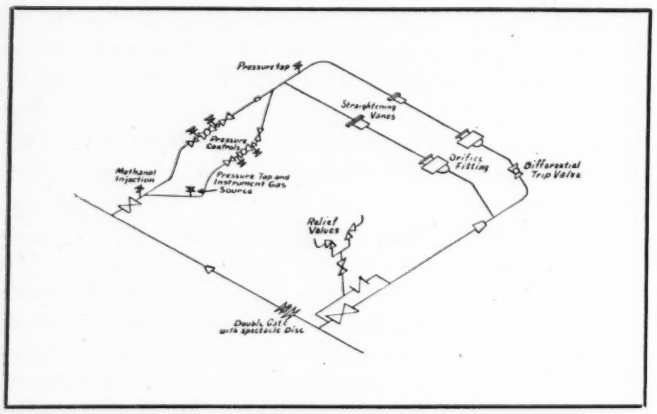
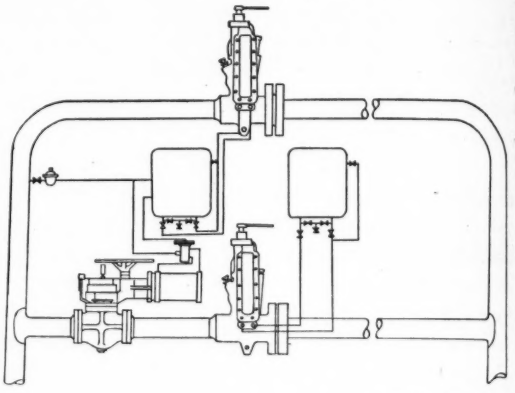


Fig. 22. The author's pet design for a small city gate station.



American Meter Co.

Fig. 23. Differential trip controller operates valve to bring an additional meter run into service.

upstream section has been limited to 0.5% using flange taps or 0.2% with pipe taps. Inasmuch as the bore of an orifice fitting is held within very close limits by factory inspection, it is recommended that this requirement be held to one-half of the tolerances for flanges, using flange taps, which would be 0.25%. All requirements for the downstream section of the meter run are double those used for the upstream section.

Component arrangements

Various ways in which available components of a meter run may be used are shown in *Fig. 18.* The straightening vanes, when used, may be pinned at the desired location or if the flange type are used they may be inserted between a pair of flanges. Weld-neck, slip-on, screwed, or Van Stone flanges or orifice fittings may be used in meter runs. In using weld-neck flanges, extreme care must be used in lining up the flange with the pipe. The use of an insert or expanding jig will add to the accuracy of the tacking. It is practically always necessary to grind the inside of the weld.

connection of "flange connections."

Orifice fittings such as those shown in *Figs. 19* and *20* have become very popular in city gate station design. Advantages of the fitting are ease of inspection, inspection without shutdown or bypassing, correct positioning of orifice in center of line, correct placement of static taps, and economy of orifice discs over conventional plates. This last advantage is nullified if plate disc carriers are used with the flanges. The orifice fitting may be installed between flanges or the approach end may be welded and the discharge end flanged. The latter method allows for removal of the discharge piece for inspection. The alignment of the approach end of the fitting is not disturbed. Use of the flange-type straightened vanes allows for removal of the upstream approach to the plate as one piece. The orifice fitting, *Fig. 21,* requires shutdown of the line for removal but incorporates the other advantages of the so-called senior-type fitting.

Design of a city gate station, according to the layout in *Fig. 22,* eliminates the need for having block valves for each meter run. Frequent inspection and

cut in. Each additional orifice meter run is cut in when the differential on the runs already in use reaches a predetermined maximum. The last meter run to be put into service will be taken out when the readings on the charts fall to a predetermined minimum. The plan of the two-meter run meter station *(Fig. 23)* shows the differential trip controller operating a piston-actuated plug cock to bring in the second meter run.

Cutting in added runs

Cutting in an additional meter run when the capacity of a displacement meter reaches maximum is accomplished by installing an orifice plate in series with the displacement meter, thus creating a differential to operate the controller. A restricting orifice must be used in series with the displacement meter to keep the flow within the operating limits of the meter.

Correct sizing of the orifices of each meter run of multiple installation is very important. Each additional run is brought into service by the differential valve of the preceding run reaching the set point of the controller. The differen-

tials of each run will then drop. If the second run of two is too large, the differential could drop low enough to cause the controller to shut off the second run. This would cause a bad cycling condition. It is easy to visualize a condition using, for example, four meter runs with all runs in operation. As the flow decreases, the differential will decrease until the trip controller with the highest differential setting will operate. Assume, for example, that the number one run has the highest setting. This will shut the valve on number two run. This differential will drop to zero and operate number three. Of course, the added load on number one run would start the valve of number two run operating immediately but not before a very bad metering condition had occurred. It is wise to calculate the system using gradually decreasing capacity ratios between each additional run. This will make the minimum differential operating point of a meter run higher than the set point for the preceding run.

Low pressure drop

Various types of valves have been used for this automatic trip operation. The most important consideration is to select a valve having a pressure drop so low that the drop through the valve will not upset flow ratios through the meter runs. One type of valve used for this service consists of a check valve design in which the clapper is operated by a diaphragm motor. This valve has limitations in opening or closing against a high differential. It operates very satisfactorily with a negligible differential pressure and at differentials created by the orifices. The check valve action allows it to seal tightly for removal of an orifice run. It could only be opened by putting the meter run back into service to decrease the differential across the valve to within the operating limit. The low pressure drop characteristic and the ability to obtain tight shutoff have caused the rubber-lined butterfly valve to be considered for this service. The double-seated diaphragm motor valve may be used but must be sized for the maximum acceptable pressure drop. The piston-operated plug-cock fulfills the requirements in addition to being the block valve for the meter run.

Some companies require two valves in a bypass to preclude delivery of any unmetered gas. This should not be necessary if a good lubricated plug-cock, properly serviced, is used. A bleed hole ½ in. or larger may be drilled into the side of the body. A bleed line and valve are installed on this tapped hole. This bleeder leads into the port of the cock when it is in the closed position. Any leakage through the first half of the cock is readily checked by this method. The combination blind flange and valves shown in *Fig. 24* may be used for this bypass service. The figure-8 disc may be used as a blind while the other part is drilled as an orifice for measurement of gas during inspection periods.

If an orifice is used for measurement of gas during inspection, static leads may be run to one of the existing differential recorders for use during this period. Measurement may also be made during these infrequent periods with a portable or temporary recorder.

RELIEF VALVES

Lawful necessity for relief valves is verified by the following excerpt from the Code for Pressure Piping ASA B31.1.

209. Pressure Reducing and Relief Devices

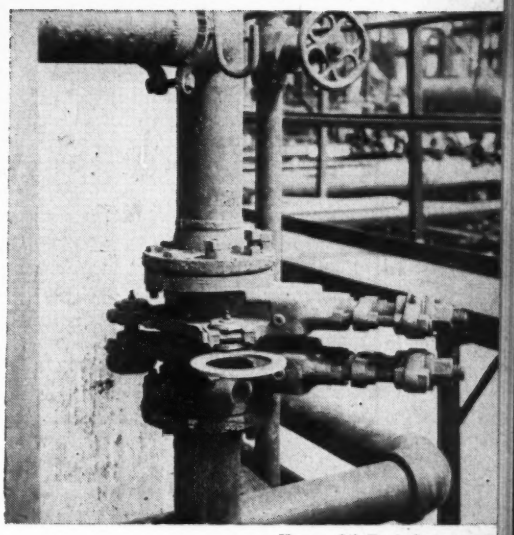
(a) Each piping system within the scope of this section supplied through one or more pressure reducing devices, the maximum inlet pressure to which is above the maximum allowable working pressure of the piping system, shall include one or more pressure relief or safety devices. Proper protection shall be provided to prevent possible injury or damage caused by discharge of gases from such devices.

(b) The combined discharge capacity of the pressure relief or safety devices and their location shall be such that the maximum allowable working pressure of the piping system shall not be exceeded by more than 10% when the pressure relief or safety valves are blowing. The relief or safety valve should be located adjoining, or as close as possible to the reducing valve.

(c) Pressure reducing and relief devices shall conform to the requirements herein provided for valves for the specified service conditions.

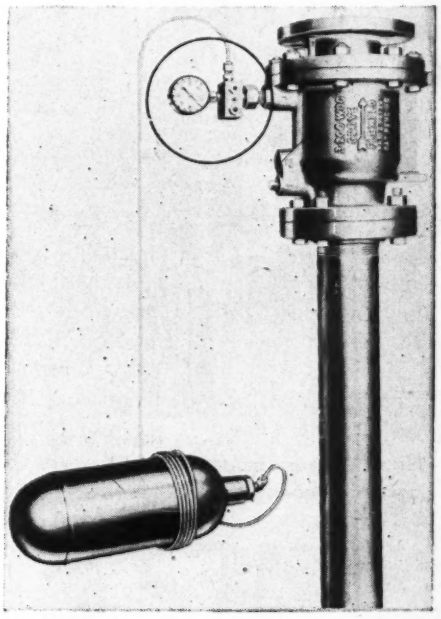
(d) A pressure gauge or connections for a pressure gauge shall be installed at the outlet of each pressure reducing device.

(e) The use of hand-controlled bypasses around reducing valves is permissible. The bypass, if used around a reducing valve, shall not be greater in capacity than the reducing valve, unless the piping is adequately protected by relief valves or meets the requirements of the higher pressure system.



Hamer Oil Tool Co.

Fig. 24. Bypass valves include orifice plate for periodic measurement through the bypass.

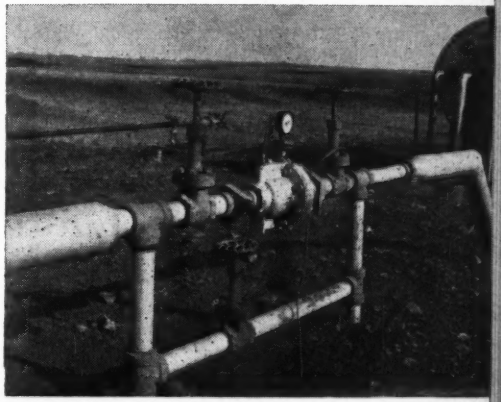


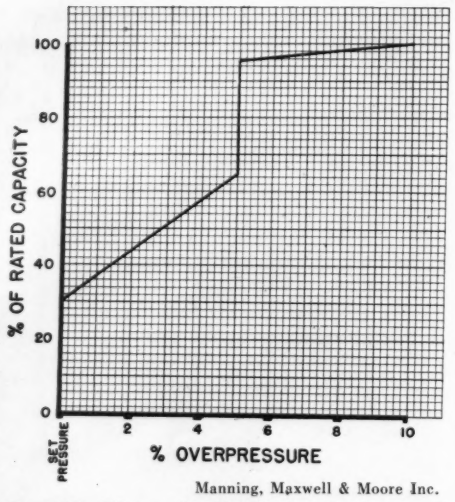
Grove Regulator Co.

Fig. 25. Relief system using the rubber sleeve valve.

Fig. 26. Predetermined pressure from supply chamber operates rubber sleeve relief valve.

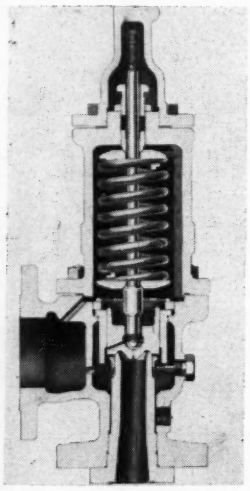
Grove Regulator Co.





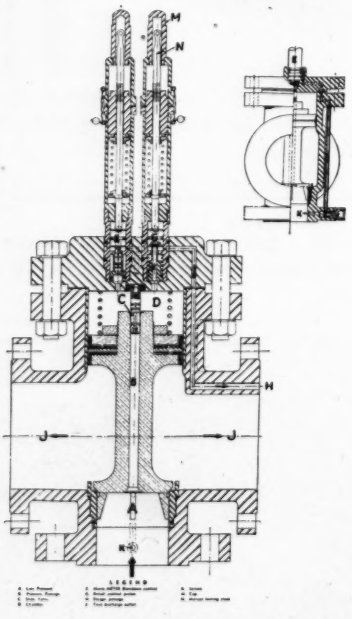
Manning, Maxwell & Moore Inc.

Fig. 27. Flow characteristic of a relief valve that has advantages for gas station use.



Manning, Maxwell & Moore Inc.

Fig. 28. Cross-section of relief valve designed to give flow characteristic in Fig. 27.



Sales Engineering Co. of Houston.

Fig. 29. Relief valve obtains close settings with individual pilots for opening and closing. Valve is actuated by line pressure.

Adherence to these rules for protection of equipment requires quite large relief valves. For example, assume that there are two regulators each capable of handling 80% of the load with the minimum transmission line pressure. Assume a transmission line minimum of 200 psi and maximum 600 psi, station discharge pressure of 100 psi, and maximum volume through the station of 1200 Mcf. These conditions indicate the use of a 2½-in. valve. Both of these valves, if wide open with 600 psig on the high side, will pass 4 MMcf. This is the figure which must be used to size the relief valves. According to the code, the set pressure of the relief valves could be 220 psig, which is the maximum allowable working pressure for the schedule 150 fittings that would most likely be used in a 100-psi station. This assumes the use of a relief valve sized for 10% over pressure. Usually the relief valves in this case would be set at about 150 psig to guarantee the operation of equipment operating off the line or to adhere to zoning requirements. Two 8-in. relief valves would be required to discharge 4 MMcf/hr to atmosphere when set at 150 psig. Although the code does not require it, true protection could only be achieved by furnishing relief capacity to take care of the flow through the bypass, if used, around the regulators. It has been assumed that the bypass will be shut unless a regulator is out of service. This assumption is based upon faith in correct operating procedures.

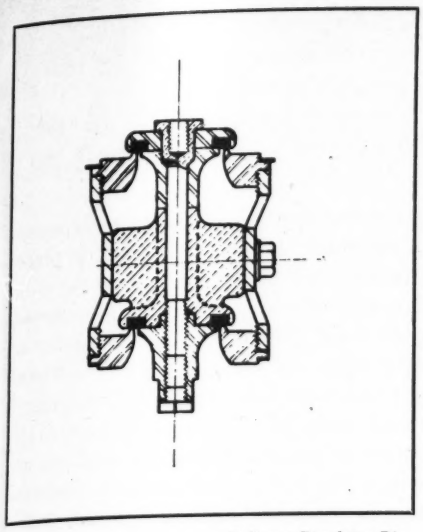
External bypass

Use of an external bypass *(Fig 22)* poses a problem in relief valve application. It is necessary to protect all station piping and equipment within the station bypass valves. Under shutdown conditions it would not take long for even a small valve leak to increase the station pressure to a point equalling that on the transmission line. For this reason it would seem necessary to install the relief valves on station piping within the confines of the isolating valves. On the other hand, a station using the bypass system is only off the line for repair or inspection, and under these conditions the pressure will be bled off. Proper operating procedures would render a relief valve within the station unnecessary.

Turning to the problem of protecting piping and equipment existing beyond the discharge valve of the station, it is apparent that to give this protection the relief valves must be placed on the line leading away from the station. The relief capacity would remain the same, assuming the station bypass valve will not pass more gas through the bypass than the regulators will pass through the station. With all equipment operating properly, opening the bypass while the station is on the line would increase the downstream pressure so that the regulators would shut off. Continued opening to allow more gas to pass than was being consumed would increase the pressure until the relief valves would unload.

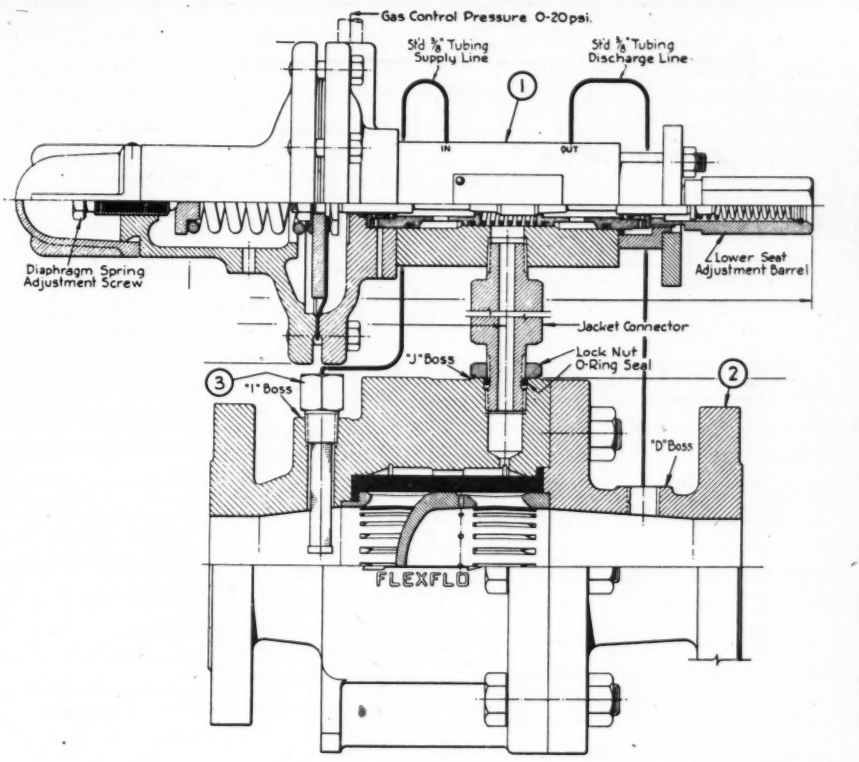
Contracts generally include a statement of minimum pressure at which gas will be supplied to the consumer. Contracts generally do not state a maximum. Under these circumstances, the transmission company does not need to take responsibility for limiting the maximum pressure. Installation of the relief valves within the station would protect the transmission company equipment at all times and consumer equipment when the station was on the line. Close control of the operation of the bypass is the only protection under this system. Use of high pressure fittings in the station rated to the maximum transmission line pressure would allow the placement of the relief system on the discharge line from the station. In the "model" design discussed later, it is suggested that a check valve could be used to connect the relief valve to the upstream or station side of the isolating valve in the discharge line from the station.

Until a very few years ago all relief valves used on gas meter stations were either of the standard reliable design like those in use for boilers, air receivers, and other plant equipment, or they were provided with spring, lever or dead-weight loaded pressure regulators. While this type of valve is very dependable, it is of the poppet type designed for rapid opening to full capacity, and the conditions which would be most likely to cause excessive pressure in a city gate station would not require the relief valve to open fully. The excessive pressure might be caused by leakage through the regulators in an amount more than the use of gas. A sticky regulator could cause pressure to build up. The relief valves that are popular for station relief application are designed for a constant controllable opening through a given over-pressure to maximum flow, a slow opening to a given over-pressure at which point the valve opens fully, or a rapid opening with a predetermined differential between opening and closing pressure.



Reliance Regulator Div.

Fig. 30. Valve unit assembly is example of an offset-type valve which gives positive lock-up.



Grove Regulator Co.

Fig. 31. Rubber sleeve valve with pilot for use as a diaphragm motor valve.

An example of the constant rate of opening of the relief valve is the system pictured in *Fig. 25.* The bomb is loaded with gas pressure sufficient to allow the rubber-sleeve valve *(Fig. 26)* to start to open. The characteristic of this valve is such that somewhat more pressure at the inlet of the valve is required to expand the rubber sleeve for maximum flow. A very useful characteristic *(Fig. 27)* to fulfill the low flow requirements of the leaky regulator and the full flow for emergency conditions, is obtained using the design in *Fig. 28.* Reference to the flow characteristic will show that at the set pressure the valve will open to allow 30% maximum flow. It continues to open so that at 5% over-pressure, 65% maximum flow has been obtained. Upon exceeding 5% over-pressure the valve opens to allow about 90% flow and continues to open until a 10% over-pressure maximum flow is obtained. This design eliminates the chattering that might otherwise be present.

Quick opening - closing

Another valve *(Fig. 29)* is designed to obtain quick opening and quick closing without chattering and with a cushioned closing. The valve is held closed by line pressure on top of the piston. This pressure may also operate a pilot relief valve (G) to unload the pressure above the piston and allow the valve to open. In the open position a slide valve (C) seals the equalizing port. The blowdown pilot (E) introduces line pressure to the chamber, thus closing the valve. Use of two pilots allows for a blowdown setting as little as one-half of 1.0% of full line pressure and as great as desired.

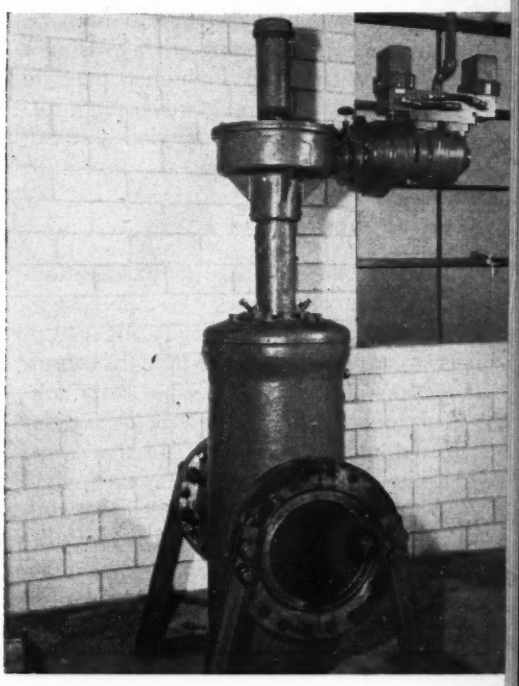
PRESSURE REGULATION

Pressure regulation is a very broad subject and has been discussed in various articles in *GAS.* Conditions affecting the selection of pressure controls for city gate station differ from those for distribution controls only in that higher pressures, greater pressure drops, larger volumes, and more stringent self-imposed operating rules exist. Transmission lines supplying gas to a city gate station will operate from 200 psi to around 1000 psi. Discharge pressures from the city gate station will very seldom be below 80 lbs and may be as high as 200 for supplies to cities or plants. Discharge pressures to secondary transmission lines will be as high as the primary transmission company will allow.

As in the selection of meter runs, access to a good crystal ball to tell what the future loads and operating conditions will be is highly desirable. The flow of gas to a newly constructed distribution system could start with zero flow and remain very low for some time. A small regulator may be installed for this period, even though the piping to and from the regulator were installed for future conditions. When widely varying load conditions exist, this regulator may be a permanent part of the installation. This smaller regulator may be set above the other regulators so that it will operate when the other valves are closed. It will be fully open when the other valves start to open.

Regulating valves selected must be able to pass gas at the highest rate required. This rate will probably occur

Fig. 32. Solenoid valves are remotely operated to control a gas motor on this large line valve.



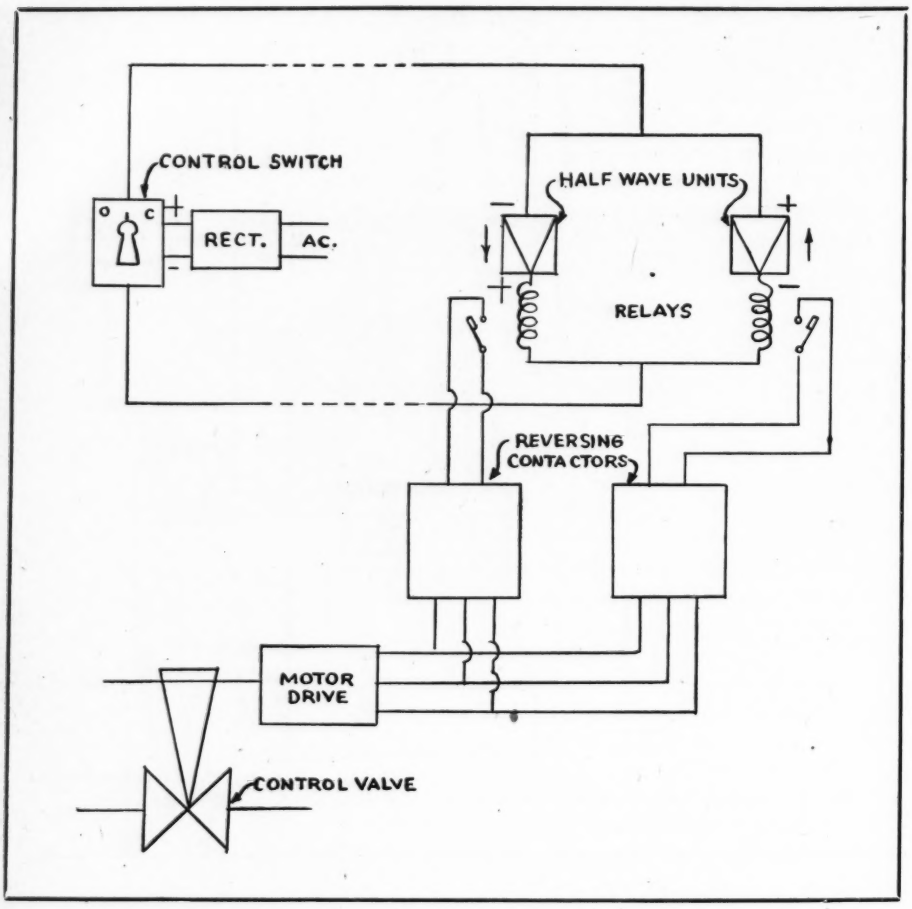


Fig. 33. Schematic diagram showing half wave rectifiers used to operate equipment.

when the transmission line pressure will be at its lowest. This rate will cause, in addition, a maximum pressure drop in the line from the transmission line to the city gate station. The maximum requirement for the valves will be the highest rate at the lowest pressure drop. The regulating valves selected must be able to control pressure when passing a minimum rate with the highest pressure drop. This condition is much more difficult to determine. As previously stated, this flow may be zero.

Sizing method

When the limiting flow conditions have been determined, the selection of the size and type of regulating equipment may proceed. Preliminary consideration of the size of valve body consists of calculating the size to use for maximum requirements and the rangeability. The Cv method may be applied to valves of all manufacturers who supply Cv data for their line of valves. Sizing charts available from the manufacturer who has obtained his data experimentally using his equipment under varying operating conditions will be more accurate than this method. It would seem to be impossible to foresee operating conditions close enough for these variations in method to cause incorrect sizing of valves for this service. The flow coefficient (Cv) of a valve is the volume of water in gpm that will flow through the body with a 1-lb drop in pressure. The maximum flow coefficient is the maximum flow that may be reached by opening the valve fully. Oddly enough, there is a wide range of Cv factors for valves of the same size—even those of supposedly the same design. The use of the Cv factor is based upon faith that the manufacturer has run tests on his products so that his published data may be used with confidence.

The following equations may be used to determine either gas flow by use of a Cv factor or the Cv for a given set of conditions.

$$Q = 61Cv\ \frac{(P_1\text{-}P_2)P_2}{G}\ \text{Temperature } 60^\circ\text{F}$$

$$Q = 1390Cv\ \frac{(P_1\text{-}P_2)P_2}{G}\ \text{Flowing Temperature}$$

$$Cv = \frac{Q\,G}{61(P_1\text{-}P_2)P_2} \text{ or } \frac{1390\,(P_1\text{-}P_2)P_2}{Q\,G\,Tf}$$

Q = flow in cfh at 14.7 psi and 60° F
P_1 = inlet pressure psia (14.7 plus psig)
P_2 = outlet pressure psia
G = specific gravity of gas - air equal 1.0
Tf = flowing temperature F abs (F plus 460)

Critical flow of gas limits the capacity of the valve. It becomes evident in practice and may be determined by thermodynamics that the velocity of a compressible fluid through an orifice reaches a maximum and that the velocity will not increase with further increase in differential pressure. This critical velocity occurs at approximately the condition at which the differential pressure becomes greater than one-half of the inlet pressure. Under these conditions the capacity formulae should be:

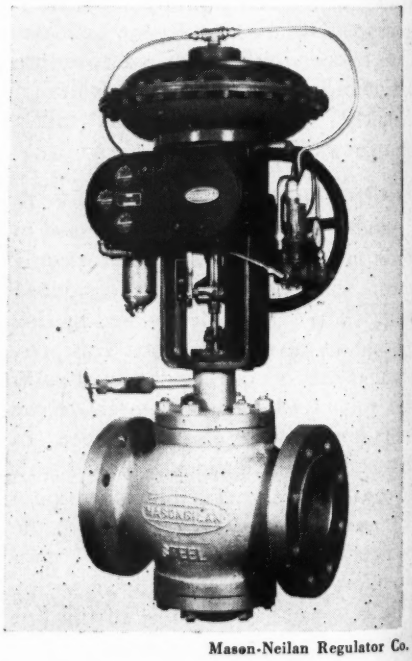
$$Q = \frac{30.5\,Cv\,P_1}{G} \text{ or } \frac{695\,Cv\,P_1}{G\,Tf}$$

and

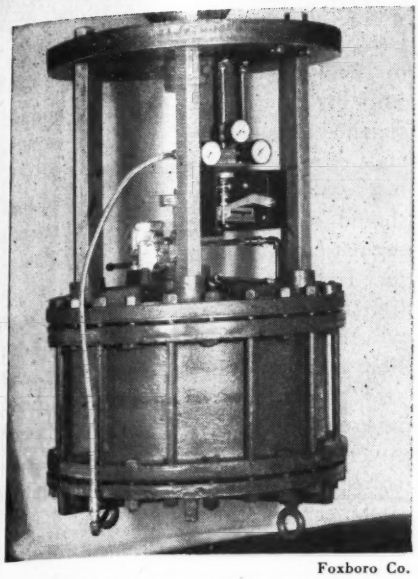
$$Cv = \frac{Q\,G}{30.5\,P_1} \text{ or } \frac{Q\,G\,Tf}{695\,P_1}$$

Using these formulae, a Cv may be determined for the flow conditions involved. Reference to the Cv data furnished by the manufacturer for his products makes it possible to select a valve which will handle the flow rate adequately. Although the quality of regulating equipment has reached a point where instances of breakdown or poor performance have become very infrequent, the importance of uninterrupted operation of the station requires serious consideration of standby regulators. This is not

Fig. 34. Springless diaphragm actuator and manual operator on gas control valve.



Mason-Neilan Regulator Co.



Foxboro Co.

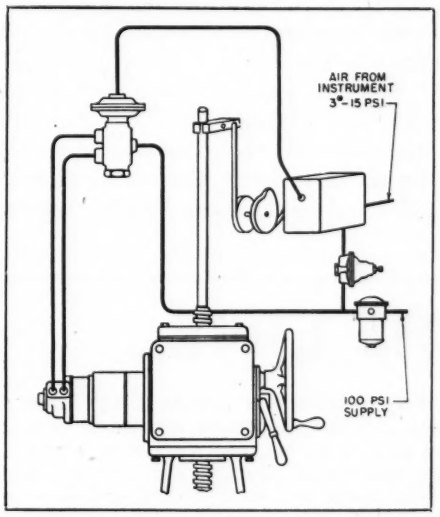
Fig. 35. High power cylinder may be positioned positively for valve actuation.

as important when the station is one of many supplying gas to a large distribution system, nor is it too important when gas is being furnished to a dual-fuel steam-electric station. It is vital to a small town with one source or to a chemical plant such as a rayon mill in which solidification of products due to loss of steam would cost thousands of dollars for clean-out and start-up.

Installations requiring a guarantee of continuity of service should use two pressure controls set for different pressures, and selected to handle from 60 to 80% of the maximum flow at minimum pressure drop. This approach is not too much of a gamble considering the remote possibility of requiring one valve to handle the load at a time when 70% of true maximum load was not sufficient for safe operation. The use of these slightly smaller valves will give better pressure control. Unless positive lock-up valves are being utilized, the use of the smaller valves will show less leakage in the closed position.

The use of an "open-on-air-failure" or "close-on-air-failure" valve must be seriously considered. The direct operated regulator using an external static line closes as the discharge pressure increases, or by accepted nomenclature is said to "open on air failure." Valves used with pilots or controllers may be either type. Both complete loss of gas by the valve closing or excessive pressure from a valve going wide open are objectionable and hazardous. The valve may be said to "close on air failure" if the system served is supplied from more than this one station, or if sufficient storage may be used until the valve again is put into service. Complete loss of gas to a community becomes a costly and dangerous condition. If the station furnishes the sole supply, the valve should open and allow the relief valves to hold a usable pressure. Use of a high pressure alarm or telemetric equipment will assist in alerting the operating personnel. One valve normally open and one valve normally closed would guarantee flow, although flow at an insufficient rate which could be detected before the condition became critical.

Valves of the parabolic plug or characterized V port type are designed for some appreciable flow in the closed position. This is necessary to allow clearance for metal expansion, misalignment, or the accumulation of foreign matter. A majority of these valves will operate with a minimum flow of 1/50th of the maximum flow or a rangeability of 50:1. The ratio of the calculated maximum flow



Conoflow Corp.

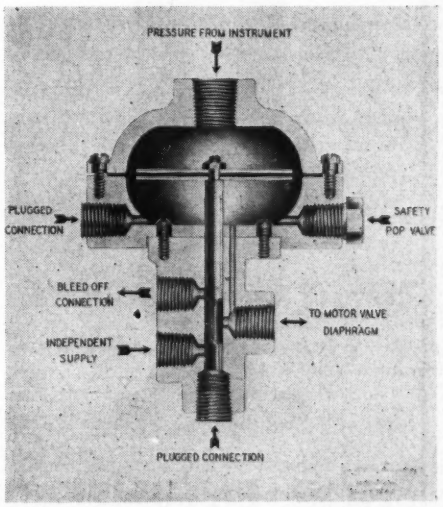
Fig. 36. Gas valve positioned accurately by gas motor in direct relation to output of controller.

condition to minimum flow condition should not exceed the rangeability of the valve to be used. To determine this the Cv for the maximum flow conditions and the Cv for the minimum flow conditions are calculated. The ratio of maximum Cv to minimum Cv is the rangeability required. Very seldom will the Cv of a commercially available valve size exactly fit the maximum Cv required. The Cv required may be any part less than 100% of the nominal sized valve. This percentage is determined by squaring the Cv required divided by the Cv of the available valve. The available rangeability then becomes this percentage divided by the percent of flow when the valve is shut. This minimum controllable flow is usually 2% for globe type control valves. Thus if the required Cv was 50 while the Cv of the next larger valve was 75, maximum flow would occur at $(^{50}/_{75})^2$ or about 45% of full flow of the valve. The usable rangeability would be $^{45}/_{2}$ or 22.5 to 1 rather than 50 to 1 for which the valve was designed.

Satisfying minimum flow conditions requires more difficult decisions than for maximum flow. Fortunately, large systems do not drop to anything like 2% of maximum at any time. Soft seats *(Fig. 30)* or the rubber-sleeve valve *(Fig. 31* will insure lock-up. Careful consideration must be given to the selection of soft seats based upon the manufacturer's recommendation for use with large pressure drops, gas containing abrasives, or high velocities which cause wire drawing. The rubber-sleeve valve is finding wide acceptance for pressure control, check valve, and relief valve service.

Stations which may be furnishing gas to a plant which may be shut down completely for an extended period can themselves be shut down. When the station is accessible this may be done manually. Remote operation using electric lines from the point of use to the station may be accomplished in many different ways. *Fig. 32* shows the operation of a gas motor by 3-way solenoids actuated from a remote location. *Fig 33* shows the use of half-wave rectifiers to reverse an electrically operated valve. Innumerable combinations of pistons, or motors with cocks or valves, may be used for this function. Exceedingly low consumption (such as the night watchman's coffee heater) can be handled through a small pounds-to-pounds self-actuated regulator which bypasses the shutoff valve.

A word of caution is needed at this point. The evils of an oversized control



Black, Sivalls & Bryson Inc.

Fig. 37. Booster pilot used to speed action of large valves.

valve are numerous, as has become evident in the discussion of valve sizing. It is advisable to install the piping of the station to handle the distant future loads giving adequate spacing for increase in valve and/or meter run sizes. The regulator should be sized for good control during the foreseeable future. A large valve body may be used with reduced ports. It is inadvisable to use a reduced port smaller than two nominal pipe sizes below the body size. Purchase of the correct size of regulator for immediate use is seldom uneconomical as it finds use elsewhere when it is replaced by the larger valve.

How much reduction?

How much pressure reduction should be allowed through one regulator? This is the subject of discussion at every gas operations meeting. The following answer was given to the question when it was addressed to the author at a recent meeting: The pressure cut is unlimited, assuming that the parts of the reducing valve are designed to withstand the velocities and unbalance, that the actuating means has the power to position the valve, and that conditions are not sympathetic to freezing.

This statement does not seem to agree with general practice as reported by W. P. Dick in his paper, "Medium and High Pressure Regulator Settings," given before the AGA. Mr. Dick reports the survey showed the use of one cut from 100 to 200 psi down to 50 psi, two cuts dropping from 300 to 400 down to 50 psi, and three cuts when the inlet pressure was between 500 and 800 psi. Later in the report Mr. Dick does sanction an 800-psig to 50-psig cut through one regulator using the two additional valves in series for protection. This may be the proper approach, although the relief valves which are required by code will protect the system with the undesirable loss of gas to the atmosphere. Present-day operation of large stations so often employs telemetric equipment to give a dispatcher or a station attendant close at hand continuous knowledge of the station operation that it would seem advisable to use an alarm rather than the series regulators to call attention to a pressure rise.

Study of valve manufacturers' literature and of talks given by engineers working with valve manufacturers will bring out evidence that regulators with all types of actuators whether spring, weight, balanced diaphragm, pilot, or instrument operated, and in all sizes up to 12 in., may be used to reduce 1200-psig gas to as low as 2 psig. Similar statements, supported by field experience, may be found that tell us that this is true of the other types. This condition should make the selection of pressure regulation equipment a very simple matter. However, further study brings to light the fact that the valve manufacturer will recommend a particular valve in his line as being superior for a particular service to other valves that also might be used. The references at the conclusion cover many phases of the study of regulators, and will help to answer the station designer's questions.

Instrument and pilot control for pressure service are now the rule rather than the exception. Instrument control consists of the use of a pneumatic controller in conjunction with a control valve positioned by an actuator. The control valve actuator may be one of many types. Most common is the diaphragm actuator in which the valve is moved through its entire travel with a given loading pressure change in opposition to a spring. Characteristics of the spring and undesirable features of large diaphragms place limits of valve size and pressure drop upon valves operated by the spring-loaded diaphragm motor.

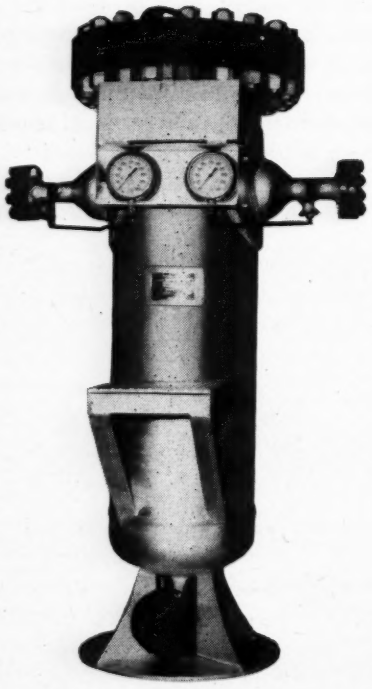
These features have been circumvented by the use of a springless motor *(Fig. 34)*. With this actuator, the lower diaphragm may be loaded with a constant pressure, or a reversing relay may change constantly the relation between the loading pressures above and below the diaphragm. The valve pictured in *Fig. 34* includes a manual operator of positive action which does not interfere with the automatic action of the valve.

The use of the reversing relay in conjunction with a valve positioner has made it possible to apply the cylinder or piston to the control valve *(Fig. 35)*. Unlimited power is available for the positioning valve. The system *(Fig. 36)* is one method of utilizing the output of a controller as the impulse for operating a large valve. This system reverses the gas-motor actuator and positions the valve very accurately in relation to the controller output.

The rubber-sleeve valve *(Fig. 31)* has been mentioned for tight service. This type of valve may be operated by the controller output or may be operated as a direct operating pressure regulator.

Electric motor drives for large valves

HOIL ON THE LINE . . .



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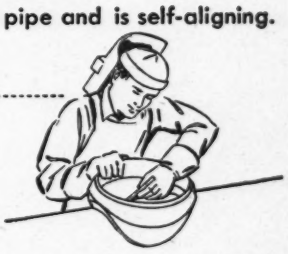
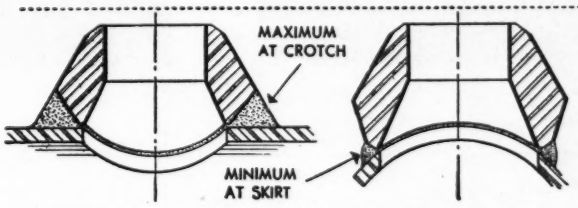


The template is the inside of the fitting. The hole in the run-pipe can be cut out either before or after the fitting is installed.



Welded as indicated—to fill in 50° bevel at crotch, blending into 35° bevel at skirt—full reinforcement is accomplished.

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3. The stringer bead—or beads—is applied completely around the base of the fitting. The established weld gap assures full penetration.
4. Additional passes are applied as necessary to fill in the tapered base bevel of the fitting. The intermediate passes should not be continuous. Re-inforcing welds should be made at the crotch bevel area at each side of the fitting only. A continuous cover bead should be added, filling the bevel at the base of the fitting at the crotch and skirt sections.

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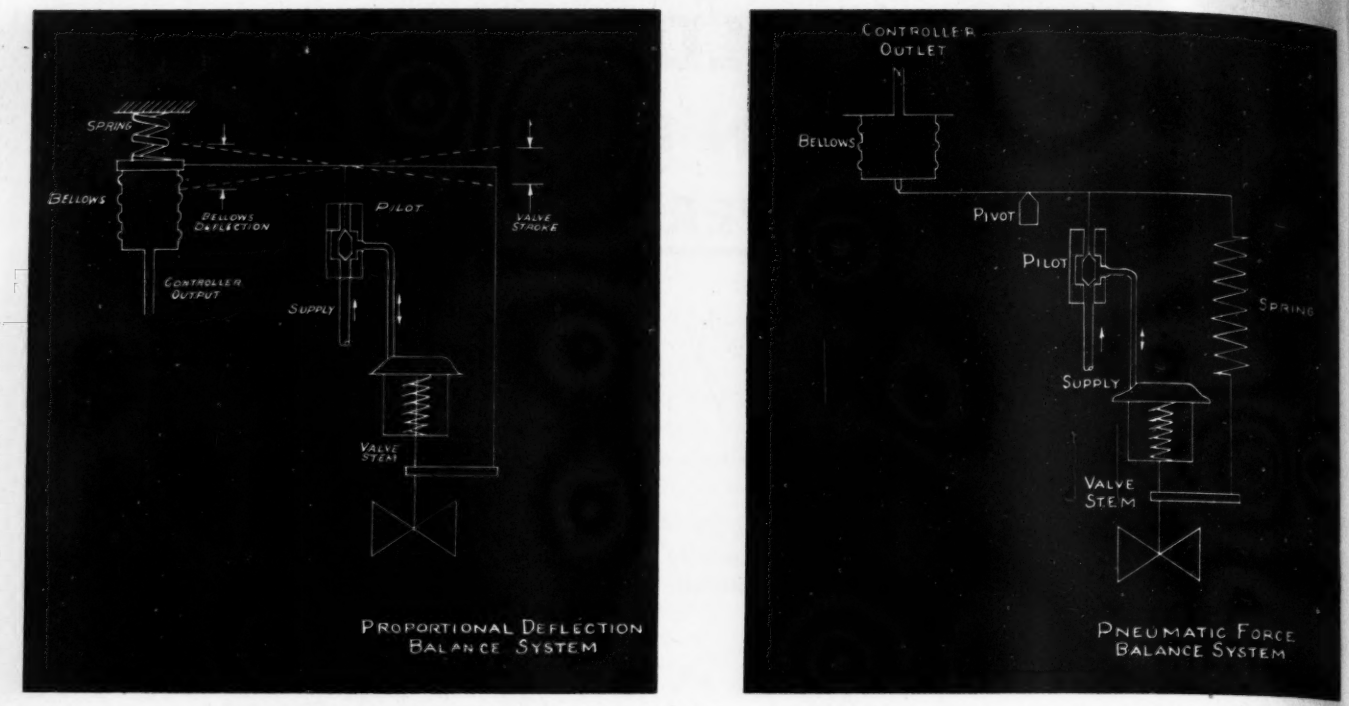

Fig. 38. Valve positioning is accomplished by the proportional deflection balance system (left) and the pneumatic force balance system (right).

probably preceded the pneumatic methods. The antipathy toward electrically operated equipment in gas stations has retarded the use of some very fine equipment. The development of electronic methods of control, incorporating the features of automatic reset and the other characteristics of pneumatic controllers, is bringing electrical equipment into the gas picture. Gas engineers should keep a watchful eye on these developments.

Greater sensitivity and accuracy may be obtained with instrument control by properly applying variable throttling range and, when required, automatic reset. Unlimited speed of actuation of the control valve may be obtained by use of a booster pilot and greatly increased power from a piston or springless motor or the valve positioner. The booster pilot *(Fig. 37)* requires very little volume addition of gas or air from the controller pilot to cause a pressure change on the diaphragm. Pressure change on the diaphragm of the booster pilot allows a much greater volume of gas or air to fill the diaphragm case of the control valve until the pressure equals the controller output pressure. The valve positioner *(Fig. 38)* continues to change the movement of the valve plug until the plug assumes the opening dictated by the controller output. In the article "Valve Positioners" appearing in *GAS* for April 1952, the following operating conditions were listed as warranting use of this valuable accessory:

1. High pressure drop across the valve.
2. Use of single-seated valves.
3. Characterized port valves 4 in. or over.
4. High pressure application requiring tight packing.
5. Non-standard pressure requirement of diaphragm or piston or non-standard output from controller.
6. Reverse valve operation.
7. Increased speed of operation.
8. Split range operations.

The valve positioner is used also for other reasons which do not apply to gas pressure control.

MEASUREMENT AHEAD OF AND AFTER REGULATION

Measurement of gas at higher pressure may be accomplished in a smaller meter run than would be required at lower pressures. The justifiable question arises, why shouldn't the measurement always be made ahead of the pressure reduction? The desire for measurement of gas at constant pressure has overcome the desire for first-cost economy. Advantage of high pressure may be taken when this high pressure remains close enough to a constant value to satisfy the measurement engineer. The pressure remains constant when the station is close enough to the transmission line so that operating flow rates do not cause wide pressure variation—providing the transmission line is held constant. This desire and necessity for constant pressure occurs because of the non-linear deviations from Boyle's Law which occur with pressure change. Because of this, the correction for supercompressibility deviation (Fpv), applied to the flow coefficient, must be changed with change in static pressure (P).

In many instances the difference between the minimum delivery pressure to be expected from the transmission line and station delivery pressure does not require a different meter run size. A slide rule calculation shows that a 6-in. meter run would be selected to measure 600 Mcf of natural gas at 400 psig using a 100-in. differential meter. The 6-in. run also would be used if the meter run was operated at 100 psig. Another factor in favor of measuring after the regulators is the economy of use of lower rated fittings.

Next month . . .

In his second and concluding installment on "City Gate Stations," Mr. Beard discusses remote transmission, dispatcher operations, characteristics of the gas, and scrubbing, and concludes with a brief outline of the elements of what he considers to be an ideal station.

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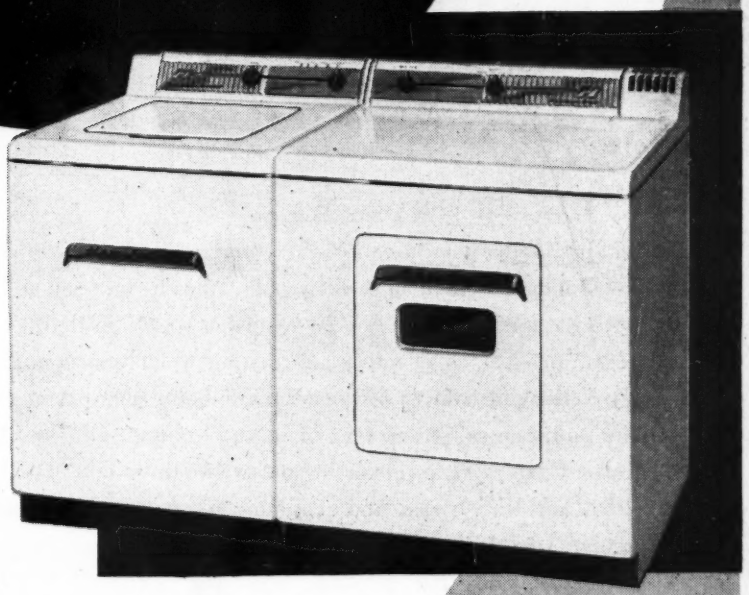

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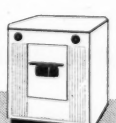

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Thermally Thinking

Continued from page 42

parties, but if it were ever given serious thought by either government, it was never done so publicly. Now, at last, we may have such reciprocation as an accomplished fact, but imposed in such a manner as to make the beneficiaries just as unhappy as the unsuccessful bidders.

Canada's dawdling has prevented an early, and possibly a relatively simple, solution to the Northwest wrangle. Prompt licensing of Northwest Natural would have kept Seattle's highly vocal N. H. Gellert happy and sped FPC action in that quarter. The California companies and El Paso would have no reason to intervene, as the San Juan basin would be omitted from contention. Other volumes of gas might have been shipped into the north central states at a price highly gratifying to Alberta. A growth schedule for TGT and Niagara Gas Transmission Ltd. might have been worked out to give fairly good saturation of the principal markets of eastern Canada.

Instead, not only is the Pacific Northwest question burning as brightly as ever, but the dominion government is faced with the task of preventing one of its own distributors from taking gas from the U. S., is shutting the door on an admittedly lucrative market (via Northern Natural Gas), and has rushed through a certificate for an eastern line which, as everyone sadly admits, might well have to be subsidized. Parenthetically, the line crosses Saskatchewan, which has gas reserves already proven up; and while they are not of sufficient volume to support substantial export as yet, it would be at least consistent for the Canadians to sit tight until it can be seen whether they ever will be.

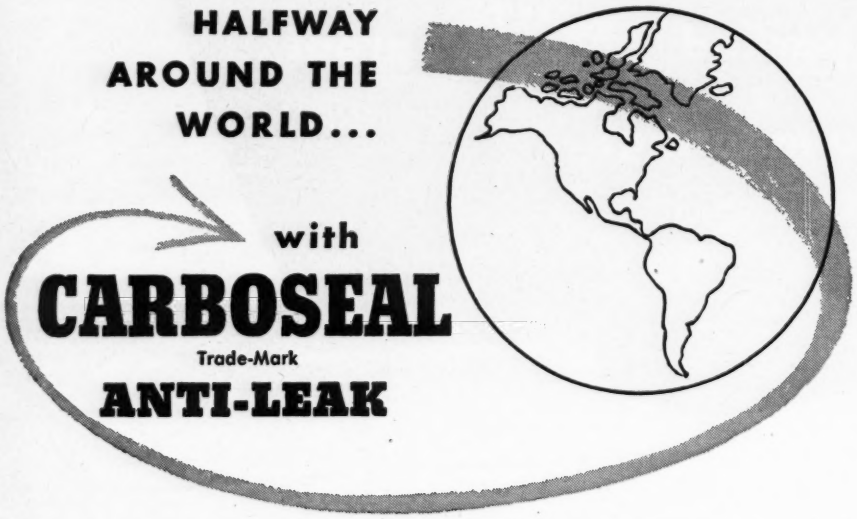
Meanwhile, Mr. Gellert remains volubly unhappy with the prospects of taking Westcoast's gas. After the export permit was granted to Westcoast, "it was my belief that Westcoast had been selected by Alberta as the sole potential supplier . . . on the basis of political considerations for the benefit of the Canadians rather than on the basis of the economic welfare of the market . . ." he says. "If Westcoast obtains a certificate, and also meets the seven conditions I have discussed (*GAS*, July, Page 114), Seattle would . . . sign a contract for a third year requirement of 38,532 Mcf per day . . ." In such a case, however, he would recommend "a slower and more cautious course of development of the gas markets in Seattle's service area . . ."

If Alberta could have foreseen that it would be bucking some powerful and wealthy gas interests who were ready to woo their markets rather than waiting to be wooed by them, it might have agreed that a small gamble was in order two or three years ago.

Coincidentally, there are other interesting aspects of the case, as it affects Tennessee Gas. Washington is saying that FPC tossed TGT the certificate for export in return for a withdrawal from its intervention in the Algonquin-New England certificate case. But, there's a chance the action won't stick, with Canada now actively fighting it. Nelson Lee Smith of FPC will also continue to battle it on the basis that it should have withheld pending settlement of the situation in Canada itself.

Mr. Smith is a patient man.

HALFWAY AROUND THE WORLD...



with CARBOSEAL Trade-Mark ANTI-LEAK

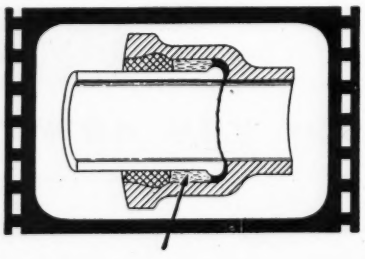
Distributors of dry gas have bought enough CARBOSEAL anti-leak to leak-proof 13,000 miles of 3-inch equivalent main. And the first bell-and-spigot joints treated with CARBOSEAL anti-leak—20 years ago—are still tight.

CARBOSEAL anti-leak is effective and lasting when unaccounted-for gas increases after changing over to a dry gas. It swells the fiber packing in a bell-and-spigot joint as much as 44 per cent of its dry volume. This swollen condition lasts, because CARBOSEAL anti-leak doesn't evaporate to any extent.

CARBOSEAL anti-leak is easy and economical to apply. You don't have to uncover every joint—just pour the anti-leak into graded mains at the high points, or spray as much as 300 feet of main from one opening with a hose and nozzle.

The cost of enough CARBOSEAL anti-leak to treat 1 mile of 3-inch equivalent main is about $100!

Get all the facts—write for our booklet, Form 4506.



SEE AND HEAR

. . . the whole story. Write today for our free 16 mm. color-sound movie that shows how two gas companies used CARBOSEAL *anti-leak.*

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WITH

*Electro-Tin Finish

*Slight Extra Cost

TITAN TANKMASTER is supreme among water heater controls. Engineering perfection combined with precision production have created a control that is SIMPLE, SAFE, SURE AND ECONOMICAL IN GAS CONSUMPTION. Features include—Precision machined metal to metal valve and seat — Larger capacity — Improved Snap-Action mechanism with true snap-action from full close to full open and vice versa — Accurate thermostatic control — Safe lighting — 100% Safety pilot — AGA Listed — Furnished with or without pilot gas filter — and NOW Electro-Tin Finish.

Both Brass and Electro-Tin Finish TITAN TANKMASTERS are available in complete Installation Kits as illustrated below.

Always first in *PERFORMANCE* . . .

Now first in *APPEARANCE*!

With ELECTRO-TIN FINISH, TITAN TANKMASTERS have a strikingly new and thrilling beauty, easy upkeep and a trim and sleek style that blends harmoniously with gleaming snow white modern water heaters and home decor . . . . Since water heaters are now prominently placed in utility rooms and kitchens this improved appearance is a MUST.

Other **Electro-Tin Finish** advantages are — Its resistance to tarnish because it resists atmospheric fumes . . . It reduces rust and corrosion to a minimum . . . With the variety of chemicals in water in various parts of the country this protective coating prevents chemical reaction and assists as a safeguard to health — like the tin coating on a food container.

Insist on Titan Tankmaster Controls with **Electro-Tin Finish** . . . They are backed by a 20-year tradition of precision craftsmanship . . . Made for use with Natural, Manufactured and Bottled Gas.

THE TITAN VALVE & MANUFACTURING COMPANY

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NEWS

Appliance servicing firms attend ConEd's school

Representatives of 16 gas appliance servicing companies in New York City as well as members of the New York State Public Service Commission and the city's Board of Health recently completed a training program sponsored by the Consolidated Edison Co. of New York.

Nearly 200 individuals reviewed good gas practices and studied intensively the installation, maintenance, and servicing of appliance controls. This and similar programs in Westchester county are designed to meet the expressed needs of people outside the utility itself.

ConEd has turned over all servicing of gas appliances to private agencies. As most servicing calls are related to the operation of controls, six manufacturers accepted invitations to share their knowledge and experience with the men who will be doing the work. A two-hour session was devoted to each of six manufacturers' products. Cooperating were A-P Controls Corp., Detroit Controls Corp., General Controls Corp., Minneapolis-Honeywell Regulator Co., Robertshaw-Fulton Controls Co., and White Rogers Electric Co.

At the first of the eight sessions, ConEd personnel reviewed AGA and company requirements for the proper installation of heating equipment. Each man received a packet of materials covering these matters as well as an orifice capacity chart, the company's gas service rules booklet, and tables for checking gas meter consumption.

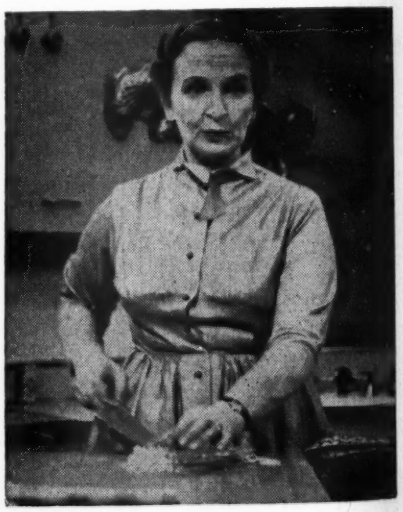
At the final session the men practiced analyzing flue gases with Fyrite CO_2 indicators. Available equipment made it possible for the men to review the use of the flue baffle in a boiler and adjustment of a conversion burner. ConEd provided five Fyrite sets as door prizes. The kits were delivered to a servicing company for its use and no company was allowed to receive more than one.

ConEd is presently preparing a complete gas servicing manual as a continuing part of its program to keep outside servicing agencies fully informed on latest developments and practices. The company will also review regularly the problems encountered by others in the field. The first such get-together is scheduled for this month.

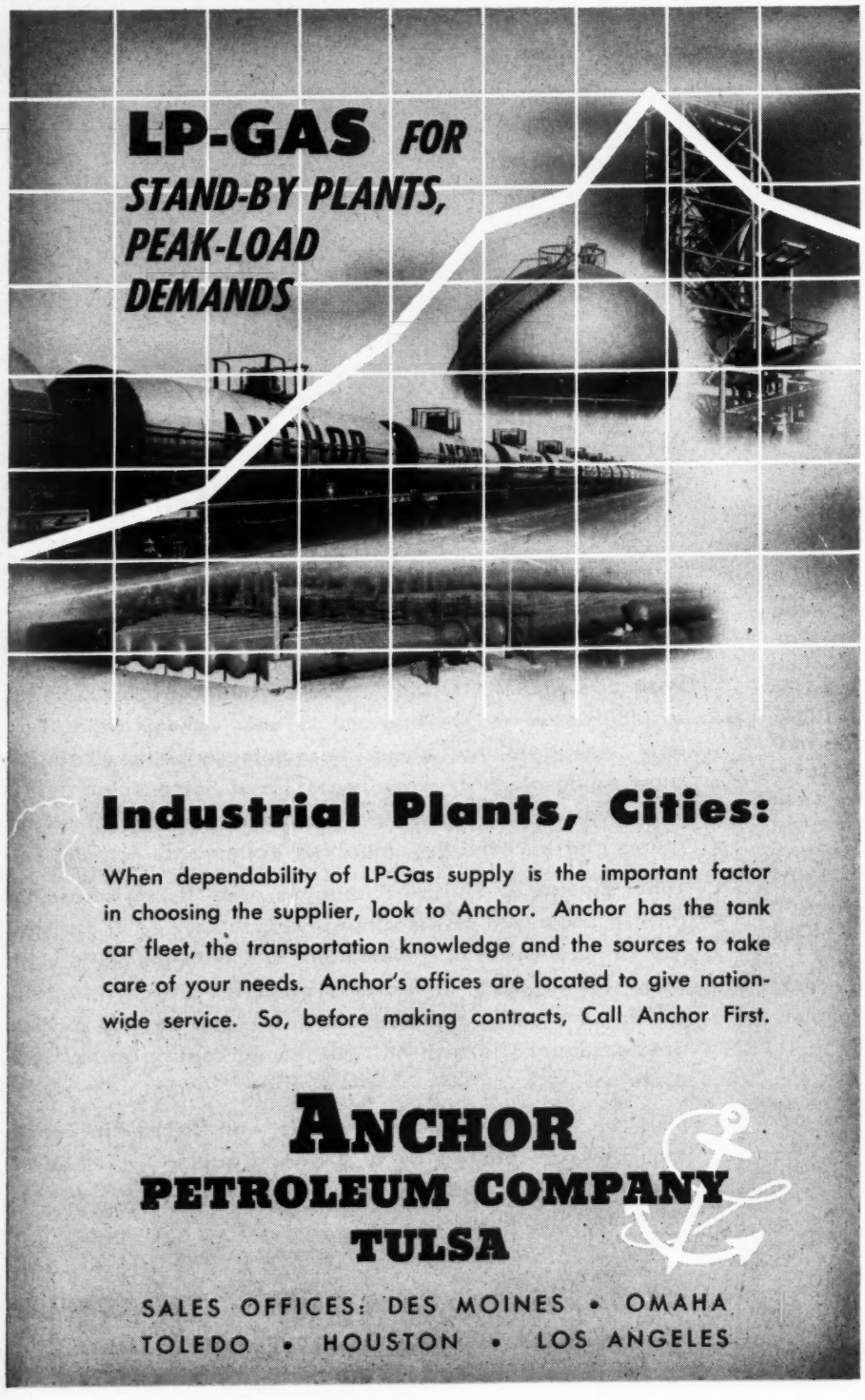
Caloric's Dione Lucas show now coast to coast

Last week, Dione Lucas baked a breast of lamb in Boston, sautéed a flounder in Miami, built a seven-layer cake in Salt Lake City, cooked an omelet in Amarillo, and demonstrated to thousands of housewives in other cities from coast to coast that cooking can be an art instead of a chore.

Mrs. Lucas' far-flung performances were on film, telecast over local stations, for the largest number of sponsors on any TV cooking show. (See June *GAS*, page 74.) The program, first filmed last April, is the major feature of Caloric Stove Corp.'s successful "Operation Blue Flame." Already the Dione



Dione Lucas, versatile television cook, demonstrating the preparation of a tasty dish which will be viewed by housewives in 15 cities from coast to coast.


LP-GAS FOR
STAND-BY PLANTS,
PEAK-LOAD
DEMANDS
Industrial Plants, Cities:
When dependability of LP-Gas supply is the important factor in choosing the supplier, look to Anchor. Anchor has the tank car fleet, the transportation knowledge and the sources to take care of your needs. Anchor's offices are located to give nationwide service. So, before making contracts, Call Anchor First.
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OPERATION BLUE FLAME

FOR GAS UTILITIES EVERYWHERE

A Great NEW TV Show featuring

CALORIC GAS COOKING STAR

Dione Lucas

WHAT IS OPERATION BLUE FLAME?

It's a colorfully presented promotional package including 26 half hour television programs starring Dione Lucas and her cooking artistry. The program is on film and is set in a New Freedom Gas Kitchen, featuring gas cooking at its finest.

WHO IS DIONE LUCAS?

TV's queen of culinary experts, Dione Lucas is the nation's leading saleswoman of gas appliances. Her programs in Boston, New York and Philadelphia have consistently *outpulled any similar show ever presented.*

MEET TODAY'S MERCHANDISING CHALLENGE!

Here's a truly low-cost merchandising program, designed specifically for the gas utility. It's a modern means to meet on a unified level the costly television productions of electric competition. And remember, this program has the solid support of not only participating utilities but also of the Caloric Stove Corporation . . . the largest advertiser in the gas range industry.

Now for the first time . . . *a national TV show* . . . available to utilities for sponsorship at the local level as part of a complete merchandising package to sell *gas* cooking to the American housewife!

The Dione Lucas Show is now being sponsored by the following utilities . . .

Arlington Gas Light Company
Beverly Gas & Electric Company
Blackstone Valley Gas & Electric Co.
Boston Consolidated Gas Company
Brockton Taunton Gas Light Company
Brooklyn Union Gas Company
Canon Gas Service Company
Central Indiana Gas Company
Citizen Gas & Coke Utility
Citizens Utilities Company
Connecticut Light & Power Company
Connecticut Power Company
Danbury & Bethel Gas & Electric Light Co.
Derby Gas and Electric Company
East Ohio Gas Company
Fall River Gas Works Company
Fitchburg Gas & Electric Light Co.
Gloucester Gas Light Company
Hartford Gas Company
Haverhill Gas Light Company
Indiana Gas & Water Company
Kokomo Gas and Fuel Company
Lawrence Gas & Electric Company
Lehigh Valley Division of United Gas Improvement Co.
Lone Star Gas Company
Lowell Gas & Electric Company
Lynn Gas & Electric Company
Malden & Melrose Gas Light Company
Michigan Consolidated Gas Company
Mississippi Valley Gas Company
New Britain Gas Light Company
New Haven Gas Light Company
North Hampton Gas Light Company
Norwood Natural Gas Company
Ohio Fuel Gas Company
Old Colony Gas Company
Peoples Water & Gas Company
Philadelphia Gas Works
Portland Gas & Coke Company
Providence Gas Company
Pueblo Gas & Fuel Company
Reading Gas Division of United Gas Improvement Co.
Salem Gas Light Company
Springfield Gas Light Company
Suburban Gas & Electric Company
Wachusett Gas Company
Wallingford Gas Light Company
Washington Gas Light Company

For complete information, write or wire to *Caloric*® STOVE CORPORATION, TOPTON, PA.

Lucas "network" has spread to 15 cities, with 28 gas utilities and a number of appliance dealers as sponsors. In several cities, utilities and gas appliance dealers co-sponsor the show: in Miami, the utility and a number of dealers split the cost of station time; in the Boston-Providence area, 19 gas utilities jointly sponsor the show; and in Amarillo, a group of dealers puts on the program.

Any gas utility, appliance dealer or department store selling gas appliances can sponsor the show. Caloric supplies the weekly show on film and sponsors select their own TV times and stations. Arrangements can be made to have filmed spots made with Mrs. Lucas giving the local sales message. In addition, a series of spots is being filmed for use by companies in the Blue Flame Operation, which will promote every type of gas appliance.

Small firms to benefit by grant to safety council

Plans have been announced by the National Safety Council for an intensified attack on accidents in small firms through the expansion of the council's small business program.

The stepped up program, which was put on a full-time basis in 1951, has been made possible by an additional annual grant from the National Assn. of Mutual Casualty Companies of $11,200, which raises the association's total annual contribution in support of this work to $23,700.

The added funds will provide increased consultation service for trade associations, local safety councils, and business groups which reach small firms.

Boost commercial cooking by promotion program

Sales of all commercial gas appliances are being boosted by the promotion program, PEP, launched last month by the industrial and commercial gas section of the AGA. PEP—representing performance-economy-profit—will be used by gas utilities in their work with local dealers for three months, ending in November.

As part of the campaign, GAMA is sponsoring a gas company contest in which three cash prizes of $300 will be awarded, one to each commercial department sales manager of the winning company in three competitive classifications, based on the size of the company.

Practical information and suggestions for conducting the campaign were contained in a portfolio mailed to member companies including mailing pieces and sales training hints. Films available include a color slide film with a script for a speaker, and the color and sound film, "Where Food Is Finest."

Script and properties for a live stage presentation on competitive cooking, as well as other material for a non-competitive show, are also available. A sales and utilization manual, "Commercial Kitchens," has been provided that includes contributions from volume cooking specialists.

Standby plant completed by Niagara Mohawk

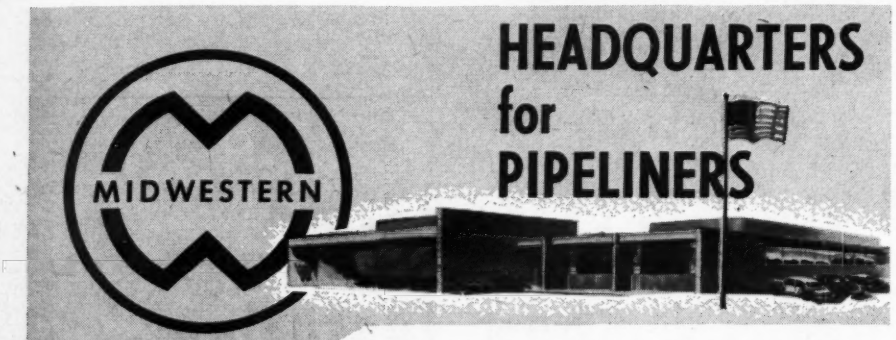
Niagara Mohawk Power Corp. has completed conversion of its Troy (N. Y.) emergency standby plant to manufacture a gas of the same heat content as its natural gas.

The converted plant, costing more than a half-million dollars, has five gas generating machines which can produce 24.5 MMcf of gas a day. They are automatically controlled to put the gas into the lines on short notice.

Central Illinois razes two old gas plants

Two obsolete manufactured gas plants of the Central Illinois Gas Co. in Peoria and Springfield are being dismantled.

Equipment to be razed in Peoria includes a 2-MMcf and a 300,000-cu ft holder, boiler plant and building, purification equipment, and water gas equipment. The plant was capable of producing only about 3 MMcf of gas a day, and in 1948 this emergency supply was augmented by in-



CORROGLAS — A thin, flexible, inorganic glass wrap longitudinally reinforced for maximum wrapping strength. Corrosion protection in rolls from 400 to 1600 feet.

OUTER WRAP — An all-glass outer wrap with less than 1% water absorption rate. High porosity reduces holidays. Perfect for use in double-coat-double-wrap operations.

KAPCO ROCK SHIELD — A mastic composition board for protecting pipe and coating in rocky areas. Drastically reduces dirt padding. Offered in various thicknesses.

ASBESTOS FELT — Answers every need where felt application is being used. A quality material backed by years of experience in the felt manufacturing business.

GLASFAB — A flexible, non-irritating glass fabric handwrap. Compatible with both hot and cold bitumens. Excellent for repair work on pipe and for coating tank bottoms.

MAGNESIUM ANODES — For positive corrosion protection against soil acids, stray underground currents. Anodes neutralize electrochemical corrosion.

PROTECTO WRAP — A plasticized coal-tar enamel impregnated into and around a woven glass fabric base. Application is fast and easy by merely "flashing" with a torch.

AND MANY OTHERS — Concrete River Weights • Tipton Line Up Clamps • Pipe Hooks • Pipe Dollies • H & M Pipe Beveling Machines • Pipe Slings • Steel Binder Tools • A & M Pipe Caps • Kraft Paper • Asbestos Felt • Plico Casing Spacers and Seals

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Tulsa 5-0144
15 SW 29th St.
Oklahoma City
CE-22527

MIDWESTERN ENGINE & EQUIPMENT CO., INC.

HOUSTON, TEXAS — D. E. HUGHES — 11410 Memorial Dr. — Holbrook 5-2223

PITTSBURGH, PA. — JOHN R. WILSON — 1422 Kansas Ave. — Whiteoak, McKeesport — Mck 2-5461

SHREVEPORT, LA. — TOM L. HOLCOMBE — Box 1306 — 5-3468

ATLANTA, GA. — RAYMOND TRAPP — 3431 Sherman Rd — Atlanta, Calhoun 4334

MT. PROSPECT, ILL. — F. J. STEINMILLER — 220 S. Owen St. — Mt. Prospect 2439

Always on the March
IN 1950
EconoTrol
Thrifty 3-in-1 burners save time, vitamins, and gas!
IN 1951
EconoMatic®
pin-point pilot, ⅓ usual size, keeps kitchen cooler than ever before!
IN 1953
Equa Flo
NEW oven burner design spreads rectangular heat pattern! No cold corners!
COMING! IN 1954
The Biggest News of all
ON OUR 75th ANNIVERSARY
HARDWICK
Since 1879
HARDWICK 75 DIAMOND JUBILEE
1879—1954
See us at the A. G. A. Convention
VISIT HARDWICK Headquarters, Jefferson Hotel
St. Louis—October 26, 27, 28
HARDWICK
AUTOMATIC GAS RANGES
HARDWICK STOVE COMPANY • CLEVELAND, TENNESSEE

stallation of a propane plant with a daily capacity of 5 MMcf. This capacity will now be increased.

In Springfield, a 1-MMcf holder, a 100,000-cu ft holder, oil storage tanks, boiler plants, and buildings will be dismantled. This standby has also been replaced by propane.

AGA to participate in 1954 choice of Mrs. America

That one of the 30 million women who cook with gas and shop in the nation's supermarkets will be selected as Mrs. America in 1954 became apparent recently with the announcement that the AGA and *Better Living* magazine will cooperate in next year's contest.

The ability to cook, shop, run a household in the modern way, and keep husband and children happy will be the qualities that count more than beauty. As a result, under this contest program, the new Mrs. America will be established as a national symbol of homemaking.

Any housewife will be eligible to compete. Entry forms will be published in *Better Living* only and deposited at one of the 9000 local independent supermarkets that sell the magazine. AGA member companies throughout the country, in cooperation with the supermarkets, will stage local elimination contests early in 1954.

The consumer side of the contest kicks off with the February issue of the magazine. More than $15,000 in prizes will be presented to the winner, including a New Freedom Gas Kitchen and laundry, completely installed in her home. In addition, each state winner will receive an all-expense paid vacation trip to Florida for herself and immediate family. Participating gas companies that conduct local elimination contests will cooperate in running the state final.

Following the selection of statewide winners early in the year, Mrs. America contest finals will be held April 21-25, 1954, at Ellinor Village, Ormond Beach, Fla. One street in the village will be renamed "Mrs. America drive," another "Better Living boulevard." All homes on Mrs. America drive will be equipped with the latest gas appliances.

The AGA will furnish all participating gas companies with a complete "How to Do It" portfolio, outlining various steps in the contest and ideas for local promotion. Included in the portfolio will be advertising mats, publicity suggestions, display materials, television, radio and public event ideas. Special promotional activities will be described, as well as step-by-step details on the running of local and state contests. One section will be devoted to ideas on how gas companies can cooperate with supermarkets to get the most value from the contest.

Supporting the gas industry's backing of the contest will be various manufacturers of gas appliances who will participate actively and join the nationwide promotional efforts.

Matchless range campaign draws inter-city interest

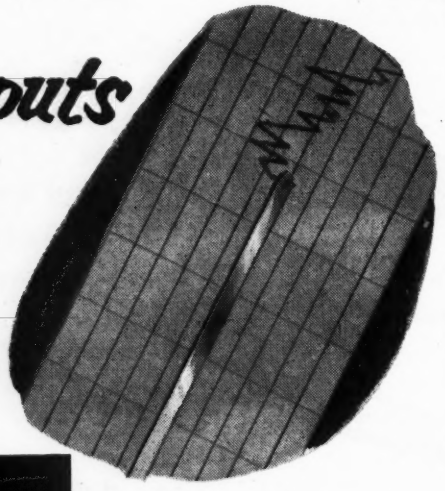
The sales departments of the Peoples Gas Light & Coke Co., Chicago, and the Philadelphia (Pa.) Gas Works have completed plans for an important retail sales contest on single-point ignition gas ranges. The first of its kind between two large metropolitan utilities, this contest is being watched closely by gas industry leaders, who consider it a major step forward in the industry's program for more aggressive selling at both the utility and dealer levels.

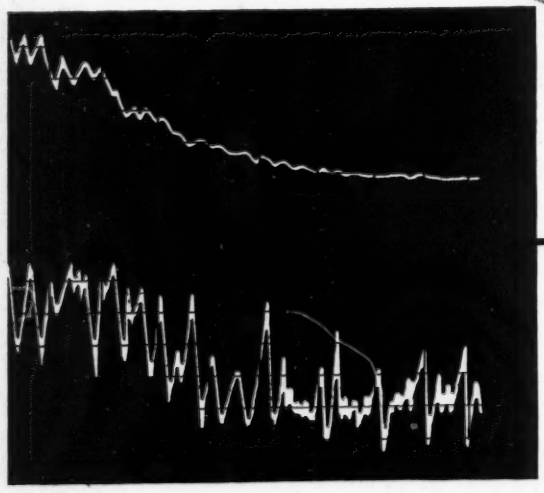
Campaign's symbol

Emphasis in the 3-month campaign will be concentrated on single-point ignition gas ranges, which both companies are selling exclusively. Arrangements for the contest have been carried out by Bernard H. Wittmann, assistant to the vice president of Peoples Gas Light, and James O. Nichols, sales manager of Philadelphia Gas.

According to Mr. Nichols, "We decided after several conferences that the contest would give both our sales organizations a

Lancaster puts the finger on friction





Cardiograph Reading On New Lancaster Metal Rim Diaphragm indicates no points of excess friction —uniform distribution of leather, perfect alignment of center pans, ideal weight and stiffness of leather, and proper amount of oil in leather.

Cardiograph Reading On New Diaphragm of Another Make (as received in proof) indicates excess friction. If installed in this condition, diaphragm would come in from 5% to 10% fast. (Diaphragm was later found to have non-uniform distribution of leather and center pans improperly aligned.)

Typical of Lancaster's leadership is the cardiograph designed by our engineers. It was extensively used in the development of Lancaster's new groove type metal rim diaphragm which has made such a hit with meter shop men.

Accurately checking differential of pressure under actual meter operating conditions, this cardiograph has put the finger on factors influencing diaphragm performance . . . and has helped determine the important new features found in the new Lancaster S-7 groove type diaphragm.

If you are not already using the new Lancaster groove type metal rim diaphragm for your small meter repairs and replacements, send for literature and prices today.

METER PARTS CO.

"SALES CLINCHERS" FOR GAS RANGE SALESMEN

No. 2 of a series

To sell her the *GAS* range, show her the "*COFFEE-WARMER*" feature of the ALLTROL® *Center Simmer*

Wonderful "keep warm" temperature of 130° to 175° —just right for keeping coffee—or food—at its flavorful best . . . deliciously hot, ready to serve! It's exclusive with ranges* featuring the Alltrol Center Simmer surface burner. And it's another reason why your prospects will become your customers.

ONLY ALLTROL BURNERS HAVE A *COMPLETE* HEAT CYCLE

Full flame Starting Burner for quick boil or fast frying.

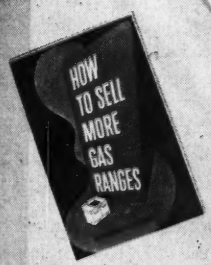
A full range of intermediate heats when wide spread of heat is needed.

Click . . . here's efficient "Center Simmer" that maintains boiling in any covered vessel.

Click . . . a gentle "Keep Warm" heat . . . without further cooking.

**Write for names of ranges featuring ALLTROL Center Simmer.*

® Trade Mark Reg. U. S. Pat. Office



SEND FOR FREE BOOKLET,
"How to Sell More Gas Ranges"
Address Dept. 103G

HARPER-WYMAN COMPANY

8562 Vincennes Avenue — Chicago 20, Illinois

"ALLTROL CENTER SIMMER" MAKES GAS THE WINNER!

ALLTROL® CENTER SIMMER

sound basis for a real competitive drive that will result in greater Matchless range sales for both companies."

"Both of us sell the same brands of ranges, and make about the same customer offer. Moreover, our interests are identical in promoting Matchless single-point ignition gas ranges exclusively," he continued. "It just seemed like a 'natural' for our sales organizations to take off their coats and compete in a friendly contest to see who can do the better job."

Because of the difference in size of territory, meters, and sales personnel, it was decided to compute the results on a 3-to-2 basis (Chicago's 3 to Philadelphia's 2). Sales quotas have been established at 1125 retail range sales for Chicago and 750 for Philadelphia. The contest covers the period from Sept. 8 to Dec. 14.

Peoples' Wittmann

Philly's Nichols

. . . direct inter-city range sales race

Mr. Nichols says that they expect to beat the quotas and he is certain that the contest will prove a big stimulus to their own and dealer sales of the single-point ignition ranges. "This is one answer to the industry's need for more aggressive appliance selling. We hope that more gas utilities will join in next spring, to make it a 3- or 4-cornered contest among companies of comparable sizes."

A trophy offered by Matchless range manufacturers will become the temporary property of the company winning this fall's contest. It will represent a permanent challenge to others who sell and promote this type of range.

Aggressive advertising and promotional campaigns have been prepared to spearhead the contest in both Philadelphia and Chicago. Meanwhile, the decks are cleared for action at the inter-city participants' headquarters. Special prizes are to be revealed to the sales personnel at Kickoff meetings in both cities. Each Monday during the contest, sales results for the preceding week will be exchanged by telegraph between the contestants. Progress charts will be displayed in all district sales offices.

Impending explosion proves to be odorant on the loose

An overpowering odor of escaping gas, which on a day in late August threw downtown Shreveport into a near-panic for fear of an impending explosion, and brought firemen, plumbers, and gas officials to the Washington-Youree hotel in anticipation of serious trouble, was finally traced to a small bottle.

And an empty one, at that.

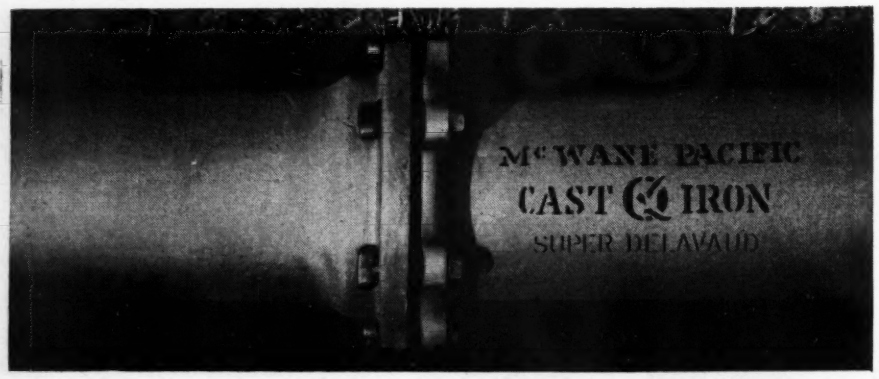
The bottle had once contained a pint or so of odorant, enough to odorize a million feet of gas. Mysteriously left in a room and turned in to the hotel's lost-and-found department, it caught the eye of a chambermaid in search of a bottle of similar dimensions.

Having use for the bottle, but none of the contents, she had casually poured the odorant into the hotel's plumbing system.

Federal charter given National Safety Council

Formal recognition by the United States government of the 40 years of leadership and activity of the National Safety Council in combatting the accident problem has been granted through the action of President Eisenhower and Congress, which granted the council articles of incorporation under a federal charter.

Ned H. Dearborn, president of the council, said the charter means little change in structure, purposes, and activity of the council, which will continue to be a privately operated and financed membership association. Legally, the transition will involve only the transfer of the council's assets as



WHIP

EXPANSION
CONTRACTION
SETTLEMENT
WITH

McWANE-PACIFIC SUPER DELAVAUD
MECHANICAL JOINT CAST IRON PIPE

Practical water or gas distribution men well know that pipe line settlement, expansion and contraction from season to season sometimes cause joint leaks in bell-and-spigot pipe lines.

This kind of trouble may be prevented in future pipe line construction by the use of McWane-Pacific Boltite mechanical joint cast iron pipe. Boltite mechanical joints stay flexible; permit settlement, expansion or contraction without leakage. The special bolts, glands, and sealed-in rubber compound gasket last as long as the pipe.

For details, wire or write McWANE CAST IRON PIPE COMPANY, Birmingham, Alabama, or PACIFIC STATES CAST IRON PIPE COMPANY, Provo, Utah. (Sales offices in principal cities.)

McWANE PACIFIC PIPE Lasts for Centuries

an Illinois corporation to the newly authorized federal corporation.

The prestige of a federal charter is now enjoyed by a limited number of public service organizations such as the American Red Cross, the Girl Scouts and the Boy Scouts, as well as leading patriotic groups.

Decker Instrument Supply organized by A. W. Decker

A. W. Decker has organized the Decker Instrument Supply Co. in Los Angeles to distribute American Meter Company specialties and the orifice fittings and accessories of Commercial Iron Works throughout California. Mr. Decker was formerly with Westcott & Gries and American Meter.

In addition to the above lines, he is handling Weston Dial and Palmer thermometers and Helicoid gauges. Decker Instrument offices are located at 2848 W. Olympic Blvd. in Los Angeles.

Summer weather knocks range shipments off

Suffering from summer doldrums, gas range shipments during July dropped 10.7% below similar shipments during the same month last year, although over-all shipments for the seven-month period ending in July were still running 6.1% ahead of 1952. In comparing this year's gas range shipments with electric, for the first six months of last year, the ratio has dropped from 1.9:1 to 1.4:1.

In the househeating and air conditioning equipment category, GAMA figures show that industry shipments of gas-fired central heating equipment in July totaled 66,600 units, 7.9% greater than in July 1952. Seven-month figures show a 14.2% gain over the first seven months of 1952.

In July, gas-fired furnace shipments were 6.3% greater than last year; gas-fired boiler shipments increased 33.3%; and gas conversion burners were 3.9% more than for the same month of last year.

Committee set up to lead utilities' range promotion

A huge advertising campaign to pep up sales of automatic-ignition gas ranges will be sponsored by eastern utilities serving 9 million people in several states. The campaign, which will feature the "matchless" gas range as a theme, is being handled by the Matchless gas promotion committee, made up of the following members:

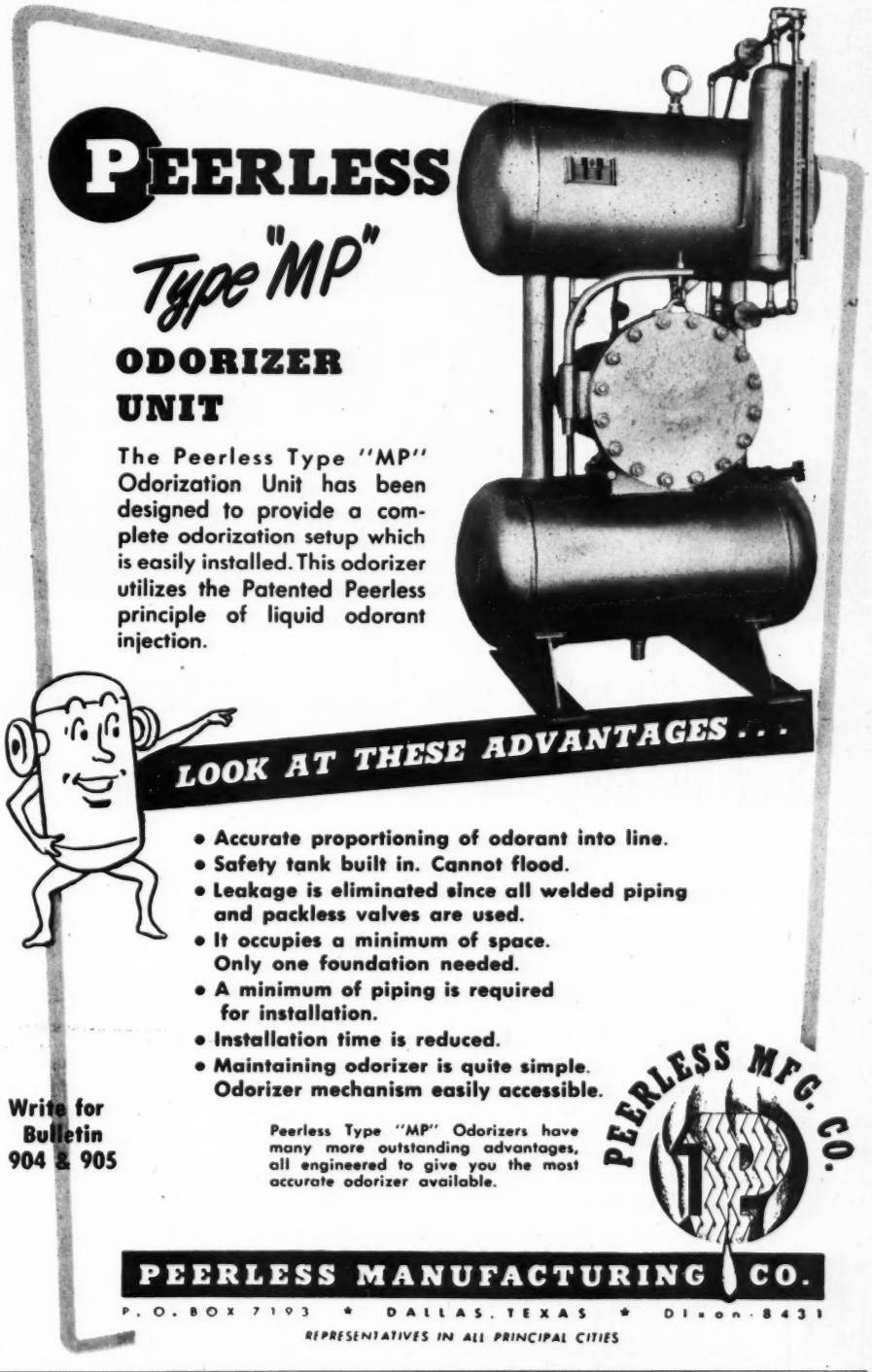
Chairman W. W. Selzer, Columbia Gas System Service Corp.; Charles E. Gordon, Columbia Gas Charleston group; R. H. Lowe and L. W. Yochum, Columbia Gas Pittsburgh group companies; Lee Corn, George Duggan, Harold Eckes, and Richard L. Leusch, East Ohio Gas Co.; Dick Conover, Equitable Gas; Bill Berry and J. Berwanger, Ohio Fuel Gas; Roman L. Pijanowski and Charles L. Yost, Peoples Natural; and J. O. Nichols and F. H. Trembly, Philadelphia Gas Works.

Live demonstrations to highlight 5th Round-Up

Special emphasis will be placed on dramatic sales demonstrations as the key point in GAMA's participation in the 1953 Old Stove Round-Up running from September through November. The demonstration theme will be pointed up in a Round-Up broadside being mailed to more than 24,000 appliance dealers, L. P. gas dealers, and utility sales executives. It is also stressed in a series of ads scheduled for the trade publication field.

In its mailings, GAMA has urged the importance of having connected ranges on the sales floor so that salesmen can demonstrate the ranges in operation. In addition, they are offering dealers a 20-page booklet, "Quickie Demos that Sell More Automatic Gas Ranges."

Individual gas range manufacturers have developed a wide variety of promotion plans to tie in with this, the fifth Round-Up. The Geo. D. Roper Corp. campaign features "Ronnie Roper, America's Favorite Cowboy"; Cribben & Sexton Co. has built its campaign around the Pied Piper; Caloric


PEERLESS
Type "MP"
ODORIZER
UNIT
The Peerless Type "MP" Odorization Unit has been designed to provide a complete odorization setup which is easily installed. This odorizer utilizes the Patented Peerless principle of liquid odorant injection.
LOOK AT THESE ADVANTAGES . . .
• Accurate proportioning of odorant into line.
• Safety tank built in. Cannot flood.
• Leakage is eliminated since all welded piping and packless valves are used.
• It occupies a minimum of space. Only one foundation needed.
• A minimum of piping is required for installation.
• Installation time is reduced.
• Maintaining odorizer is quite simple. Odorizer mechanism easily accessible.
Write for Bulletin 904 & 905
Peerless Type "MP" Odorizers have many more outstanding advantages, all engineered to give you the most accurate odorizer available.
PEERLESS MFG. CO.
PEERLESS MANUFACTURING CO.
P. O. BOX 7193 ★ DALLAS, TEXAS ★ DIxon 8431
REPRESENTATIVES IN ALL PRINCIPAL CITIES

Washington Gas Light Company, Washington, D. C.

Washington Gas Light Company finds Honeywell Controls help maintain high standards of service

Providing fine gas service is a tradition long observed by this famous utility company in the nation's capital. Realizing that equipment is important in providing good service to gas heating customers, the company recommends only top-quality equipment with a *proved* record of performance. This assures fine, dependable operation—which helps customer relations.

Honeywell Controls rate high on this list of "preferred equipment." For, over the years, Honeywell Controls have given accurate, dependable performance in thousands of Washington homes. In fact, Honeywell Controls are used in a majority of 125,000 gas-heated homes served by the Washington Gas Light Company.

The fine over-all performance of Honeywell Controls has helped considerably in achieving a high record of satisfaction among home heating customers, according to Washington Gas Light Company officials. More details on the interesting operations of this leading utility can be found on the opposite page.

For information on how Honeywell can help your utility company, call one of the 104 Honeywell offices located in key cities from coast to coast. Service is fast and friendly—and there's always a specialist available to help train your personnel on control installations.

H HONEYWELL

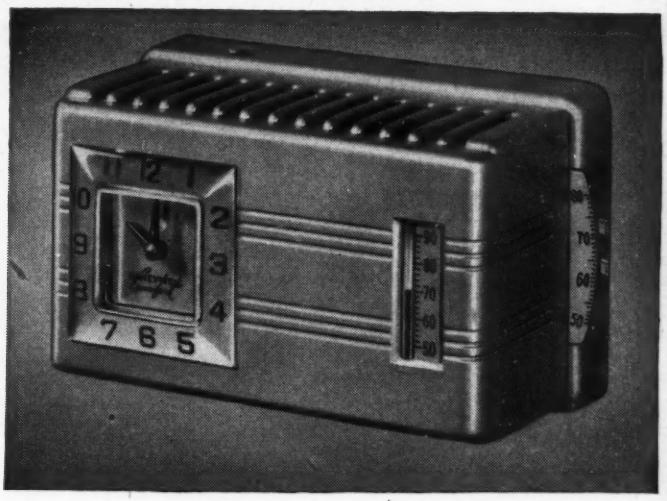
Another Plus-Profit Story from Honeywell!

Honeywell Controls popular with Washington's growing family of new gas heat customers

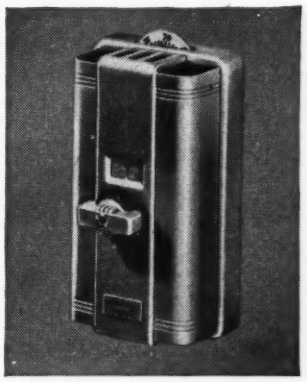
Demand for gas heat is growing rapidly in Washington, just as it is elsewhere in the nation. To meet this demand and take care of new gas heating customers, the Washington Gas Light Company has completed a 42-million-dollar post war expansion program.

New customers apparently are no different than the old in their acceptance of Honeywell Controls. They have learned about the accurate, dependable performance Honeywell Controls are giving day after day in thousands of Washington homes. This, added to the fine "trouble-free" service reputation of Honeywell Controls, helps explain why most of Washington's new customers prefer Honeywell.

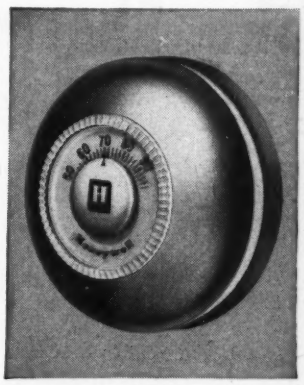
For example, the famous Honeywell thermostats, shown here, are usually well-known to customers converting to gas heat. The special favorite is the wonderful Honeywell Electric Clock Thermostat that automatically turns the heat *down* at night and *up* in the morning for luxurious heating convenience.



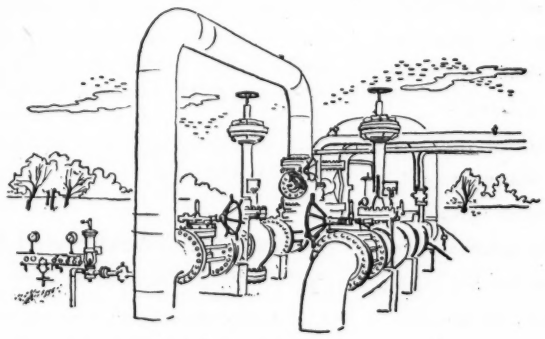
Honeywell Chronotherm—the famous electric clock thermostat that automatically turns the heat *down* at night—and *up* in the morning.



Honeywell Time-O-Stat—accurately controls heat. Works like an alarm clock to give automatic morning pick-up.



Honeywell Round Thermostat—newest thing in manual thermostats. Improved design. Blends with the wall.



Huge underground gas storage project completed

To meet the growing public demand for gas heat, the Washington Gas Light Company recently completed large stand-by storage facilities following complete conversion to Natural Gas. This project was widely recognized as one of the first and largest of its kind ever undertaken by a utility company.

Modern display rooms for customer convenience

This smart kitchen has been installed in one of the company's attractive customer showrooms. Here the public may pay bills, request various services, and see the latest gas equipment and appliances. It's another good example of the methods this one-hundred-year-old utility company uses to maintain a high level of customer satisfaction.

For illustrated literature and application data about the Chronotherm or any other Honeywell control, call your local Honeywell office. Or write Honeywell, Dept. GS-10-81, Minneapolis 8, Minnesota.

MINNEAPOLIS **Honeywell**

First in Controls

Stove Corp. will use its biggest advertising budget in company history; Magic Chef Inc. is using ads in *Life* magazine and the Dave Garroway television show; Tappan Stove Co. is concentrating its major attention on point-of-sale promotions; and Hardwick Stove Co. is focussing its attention on "matchless" ranges.

Gas revenues up 26.9% in June, FPC reports

Federal Power Commission reports that operating revenues of natural gas companies totaled $158,282,795 in June, an increase of 26.9% over June 1952. For the 12 months ended June 30, revenues aggregated $2,163,962,625, or 20.9% higher than the $1,789,517,518 received in the previous 12 months.

Gas sales to ultimate consumers during the month of June were 205,909 MMcf, an increase of 16.7% over June 1952.

Sales to residential, commercial, and industrial consumers increased 8.1%, 11.0%, and 20.4% respectively, while revenues from the three classes of service increased 13.7%, 17.3%, and 31.3% respectively. Revenues from all sales to ultimate consumers increased 22.6%, amounting to $66,425,690.

These men attended the transmission and distribution course at the second annual refresher course in gas engineering presented by the Institute of Gas Technology this summer. Front row (from left): R. F. Bukacek, IGT instructor; Albert W. Buckley, Roanoke Gas; W. M. Stanley, C. J. Conrad, R. K. Hansen, Manufacturers Light; IGT Director E. S. Pettyjohn; William N. Darling, Henry F. Giblin, Peoples Gas Light; Roy F. Roberts, James H. Rhodes Jr., Alabama Gas; Bert E. Eakin, IGT instructor. Second row: Mal C. McCallum, Seattle Gas; Bernie Wilenzick, Interstate Natural; Harry A. Moore, Harry J. Schneider, Rockwell Manufacturing; Kenneth Wharff, Michigan-Wisconsin; Charles S. McGee, Kansas-Colorado; Donald C. Hulbert, Rochester Gas; Tom B. Henshaw, Portland Gas & Coke. Third row: Paul A. Hoglund, Seattle Gas; Parry Keller, Harvey W. Preslan, Raymond A. Day, East Ohio; Carl Howell, Washington Gas; Robert R. Dixon, Natural Gas Pipeline; William K. Holm, Texas Illinois Natural Gas; John F. Dolson, Natural Gas Pipeline. Fourth row: Thomas J. Quayle, Edward R. Rogers Jr., East Ohio Gas; Richard F. Kruger, Brooklyn Borough; B. Frank Harris, Consolidated Gas. Fifth row: Ira E. Kanter, George N. Numsen, Richard W. Huffman, Ralph G. Zelmer, Eugene F. Witt, Richard N. Miller, George F. Field, and Gerald J. Robertson, all IGT fellows.

American Meter will tell gas story to domestic user

Supplementing the company's regular trade paper advertising, American Meter Co. has instituted a national advertising campaign in a consumer publication, the *Saturday Evening Post.*

The campaign is intended to promote the comfort, convenience, and economies of the all-gas home rather than the company's products, it has been announced. Subsequent development of the program will hinge to a great extent upon industry and consumer reaction.

Believed by company officials to be the first of its kind to be adopted by a supplier to the gas industry, the campaign stresses the superior features of gas cooking, refrigeration, water heating, clothes drying, air conditioning, and incineration.

For Many Pipeline Jobs, *Only* the Sherman *Power* Digger is Practical

The Sherman Power Digger operates with precise, fingertip control. It swings at a 140° arc with a reach of 10 ft. behind the tractor and 8 ft. below grade.

Get the most out of the pipeline digging equipment you now have by keeping it on your big pipe-laying work.

On maintenance jobs where giant equipment and manual labor are both impractical, use a Sherman Hydraulic Power Digger. It uncovers pipeline quickly—at low cost. You can buy the digger plus the light, rubber-tired tractor to which it is fitted for less than the cost of many automobiles.

For complete information on how the Sherman will cut your pipeline maintenance costs and release your other equipment for big jobs, write today for free descriptive literature J2.

Designed, Engineered and Manufactured Jointly by
SHERMAN PRODUCTS, Inc.
Royal Oak, Michigan
WAIN-ROY CORPORATION
Hubbardston, Mass.

•

Patent No. 2,303,825
Other patents pending

Sherman
PRODUCTS, INC.
ROYAL OAK, MICHIGAN
Sherman SP Products

BASO®

Automatic SAFETY PILOTS

provide simple automatic shut-off economically for sizes to 1¼ inch

These Baso Valves give simple automatic 100% shut-off, to products ranging from space heaters to large ovens. Sized from ¼" to 1¼", they all have aluminum-alloy bodies and replaceable hood and reset assemblies. All live up to the Baso reputation for precision and service derived from the reliability of thermocouple operation

Your equipment and your reputation gain when you use Milwaukee Gas Specialty products. That word "Specialty" means special controls, mass produced at mass production prices to meet the particular needs of one manufacturer or a thousand—to meet *your* needs and to save *you* money.

Convenient Baso Replacement Depots all over the country mean quick availability of replacement parts.

WRITE FOR BULLETINS and for the address of the nearest Baso Replacement Depot.

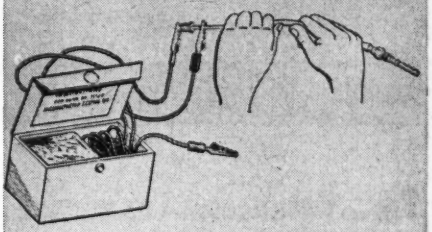
MILWAUKEE GAS SPECIALTY CO.
MILWAUKEE 1
WISCONSIN

for SERVICE MEN only

Thermocouple Testing with Matches

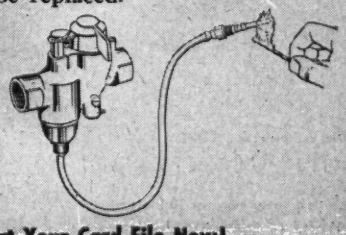
1. Short Circuit Check

With thermocouple attached to a millivoltmeter, heat the hot junction with three paper matches for a period of ten to fifteen seconds. Remove matches and bend the lead slightly at various places while observing the meter dial. If the needle slowly and steadily moves toward the zero mark, there is no indication of a short circuit. If the needle drops suddenly or is erratic in its travel, a short circuit or broken inner wire is indicated and the thermocouple should be replaced. With no reading, replace the lead.



2. Performance Check

Attach the thermocouple to a control that is known to be in satisfactory working order. Heat the hot junction of the thermocouple with three paper matches for a period of fifteen seconds or until you can no longer hold the matches. Reset the control immediately. If the control holds open, even momentarily, the thermocouple can be considered in good operating condition. If the control will not hold open, allow the thermocouple to cool and repeat the test. If the control will not hold open on the second test, the thermocouple can be considered inoperative and should be replaced.



Start Your Card File Now!

MILWAUKEE GAS SPECIALTY CO.
Milwaukee 1, Wisconsin

Please begin sending me your new Service Suggestion Cards for my file. I understand that they are free.

Name.....

Address.....

City.....Zone...State.....

☐ Please send the name of the Baso Replacement Depot nearest me.

GG-2

News Notes

McCabe-Powers Auto Body Co., St. Louis, Mo., has opened its new western regional office in Oakland, Calif., where distribution of the company's equipment in the seven western states will be handled. The operation there is headed up by A. J. Macho, western regional manager.

Two new distributors have been appointed by Servel Inc., Evansville, Ind. Hollander & Co. Inc., St. Louis, will distribute Servel refrigerators, freezers, room air conditioners, and gas and electric water heaters in western and southwestern Illinois and eastern Missouri. Harry F. Haldeman Inc., Los Angeles, is the new southern California distributor for Servel air conditioning equipment.

Harper-Wyman Co., Chicago, has been cited by the National Safety Council for what is believed by the council to be the longest injury-free period achieved by any manufacturer in the heating equipment industry. The mark set is 5,345,270 consecutive man-hours without a disabling injury. The company continues to set a new mark as long as its accident record remains unblemished. The period covered by the award extends from Jan. 14, 1944 through Dec. 31, 1952.

More than half of its production of console model gas ranges will soon be in colors instead of the traditional white, it is believed by Chambers Corp., Shelbyville, Ind. The percentage of colored ranges sold as compared with white has increased steadily since their introduction four years ago and at present nearly 40% of Chambers' console range business is in the color category.

To cover a raise in the price of gas it buys from three wholesale suppliers, the Peoples Natural Gas Co., Pittsburgh, has been authorized by the public utility commission to put into effect this month a $2,185,000 annual rate increase. The commission also approved a $2,734,000 increase which became effective in June 1952 on a temporary basis.

The Ohio Fuel Gas Co., Columbus, will spend $90,000 in the next two months to improve service in Bexley. The project calls for replacing two existing pipelines with new and larger pipe. When these two jobs are completed, plus one already in service, Ohio Fuel will have spent nearly $100,000 in the community to improve service before winter.

Production of plastic pipe and fittings was expected to be under way last month in Carlon Products Corp.'s new plant in Klamath Falls, Ore. The new plant, managed by Floyd Wilson, will be used to alleviate distribution problems in the far west.

Current Reading

THERMAL REQUIREMENTS FOR THE GASIFICATION OF LIGNITE IN AN EXTERNALLY HEATED RETORT—The U. S. Bureau of Mines has reviewed and correlated thermal data taken from tests conducted in its pilot plant at Grand Forks, N. D. The report has been prepared by M. H. Chetrick, consulting bureau chemical engineer at Grand Forks, and contains graphs as well as comprehensive tables.

A free copy of the report, No. 4957, is available from the Publications Distribution Section, Bureau of Mines, 4800 Forbes St., Pittsburgh 13.

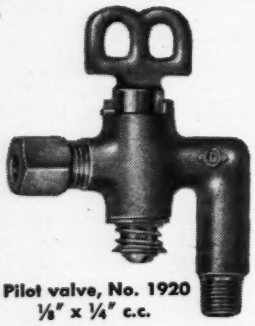
SODA CRACKER BAKING IN CONTINUOUS BAND OVENS—Information Letter No. 56 has been prepared by Joseph Kahn of the Peoples Gas Light & Coke Co., Chicago, for the food processing subcommittee and has been issued by the industrial processing committee of the AGA industrial and commercial gas section.

The specialized baking operation covered in this letter is thoroughly described and it serves as a useful bulletin for instruction and reference material for industrial gas engineers, particularly those with present or prospective cracker baking customers. For copies, write the AGA, 420 Lexington Ave., New York.

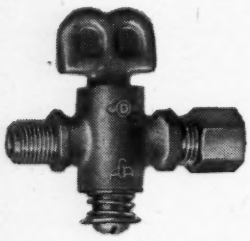
VALVES
For The GAS
HEATING INDUSTRY

Main shut-off valve, No. 2,000
Sizes: ½", ¾", 1", 1¼", 1½".

For...Furnaces...Conversion Burners...All Heating Equipment



Pilot valve, No. 1920
⅛" x ¼" c.c.



Pilot valve, No. 1910
⅛" x ¼" c.c.

These are only two of the complete line of pilot valves currently being supplied to the industry.

Continued expansion of the Gas Heating Industry will be dependent in part on the maintenance of the present high level of customer satisfaction. That's where valves come in—valves that can be depended upon to withstand torque and abuse—valves that won't talk back to you through customer complaints—valves designed to assure satisfaction for the life of the equipment.

These are some of the advantages gained when "Detroit Brass" valves are specified. Detroit Brass Valves are produced from highest quality brass, strongly constructed and A. G. A. approved. Produced by a pioneer company in the gas valve field, they bring to the user the advantage of long experience in research, engineering and field testing. They spell satisfaction to you and your customers.

Gas Appliance Fittings produced by Detroit Brass & Malleable Co. include a complete line of valves for ranges, water heaters, space heaters, furnaces and all other types of gas equipment.

GAS VALVE DIVISION
DETROIT BRASS & MALLEABLE CO.
DETROIT 9, MICHIGAN

MULTI-PURPOSE PRESSURE REDUCING

GAS REGULATOR

The Fisher Type 99 is truly a *multi-purpose regulator*—its *versatility* makes it adaptable to *hundreds of applications* now requiring an assortment of several types of regulators. It's as handy and useful as an extra vest pocket.

Because of its *unexcelled performance* and wide range of application, it is the ideal regulator to *always* have in stock.

For complete details, write for Fisher Bulletin P-99A.

CAPACITY:

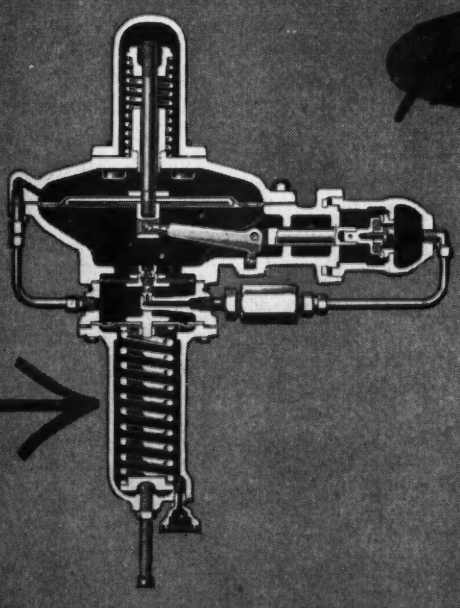
99,000 CFH at 100 PSI inlet pressure.

VERSATILITY:

For engine fuel systems, for industrials and for gas distribution systems.

PILOTS:

Low Pressure—3 springs—4 oz. to 2 PSI;
2 PSI to 10 PSI;
10 PSI to 20 PSI.
High Pressure . . . . . 10 PSI to 65 PSI.



- Factory pre-set spring provides powerful lock-off action.
- Large, effective area of main diaphragm in combination with relay pilot assures trouble-free accuracy.
- 2" threaded inlet and outlet. Hi-tensile iron and bronze body for up to 250 PSI inlet.
- Composition valve disc assures tight shut-off on zero flow and excellent regulation from no flow to maximum capacity.

COMPANY Marshalltown, Iowa

FISHER

Since 1880

BETTER GAS PRESSURE CONTROL

People

Promotions

As a result of the retirement of EDWARD M. BORGER, JOHN J. JACOB JR. has become president of the Peoples Natural Gas Co., Pittsburgh. Mr. Borger has also retired as chairman of the board of New York State Natural Gas Corp. and as director of Consolidated Natural Gas Co. Several promotions have also been announced by the company. RICHARD J. PLANK is now general superintendent; RICHARD E. DU VALL succeeds him as superintendent of distribution and is assisted by HOWARD M. JOINER; JAMES B. SAYERS, secretary and chief counsel, has been elected a director; WALTER E. MCWILLIAMS is manager of the industrial and commercial division; and WILLIAM SPENCER is assistant chief mechanical engineer.

E. M. Borger

J. J. Jacob Jr.
Peoples Natural

R. J. Plank
Peoples Natural

R. J. Fitzgerald
Electro Rust-Proofing

R. J. FITZGERALD has been appointed district manager of Electro Rust-Proofing Corp.'s Middle Atlantic states division, covering southern Pennsylvania, Maryland, Delaware, Virginia, and North Carolina. He will headquarter in Washington, D. C.

H. E. SCHALL has been promoted to controller and assistant treasurer and I. J. NEWELL to assistant controller and cost supervisor of Glass Fibers Inc., Toledo, Ohio.

Following the retirement of ELTING HENDERSON as manager of distribution for Southern California Gas Co., Los Angeles, R. I. SNYDER will assume the responsibilities of the position. A revised department organization has also been announced, with the following changes: L. R. PICKUP, superintendent of distribution; G. M. BABBE, staff engineer in charge of work measurement, methods analysis, and cost control activities; R. D. POMEROY, staff engineer in charge of training, classification, forms and clerical procedures, and operating practices; H. A. PROCTOR, manager of engineering department; and T. S. MILLER, staff engineer.

REID GLOVER has been promoted to district manager for the Arkansas Western Gas Co.'s River Valley district properties. The company has also announced that RAY W. WILMOTH, who has been foreman for the Springdale office, has been made assistant town plant manager there.

Reid Glover
Arkansas Western

E. M. Cloran
Rockwell

E. M. CLORAN has been promoted to the position of district manager of the Los Angeles district office of Rockwell Manufac-

No Longer is it Necessary to Invest in Dual Fuel to Utilize Gas.

just *Add* gas!

***with* WEBSTER'S**
REVOLUTIONARY
PACKAGED RECTILINEAR* GAS BURNER

The Packaged Rectilinear makes four inches pressure do the work of four pounds with fractional horsepower. You can fire gas — automatically — through any narrow opening without disturbing your present firing equipment — hand or stoker fired coal, oil or whatever it may be.

WRITE FOR..LITERATURE

*Trademark

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

Sell the glass-lined water heater

proved in over 2 million homes!

A.O. Smith Permaglas®

to help you sell

Exclusive *Heetwall* feature saves fuel, heats water faster, prevents "off-time" cool off! Glass-surfaced steel tank can't rust, won't crack, chip or check! Super-safe *Gasapack* controls! Many other features . . . plus the strongest, most consistent advertising and sales promotion support in the industry: leading publications, store displays, product literature, dealer identification, ad mats and miscellaneous promotions . . . makes selling *Permaglas* water heaters a profitable pleasure!

Write, now, for full particulars, Dept. G-1053

There's only one Permaglas and it's made by **A.O.Smith** CORPORATION

Permaglas - Heating Division, Kankakee, Illinois • Licensee in Canada: John Inglis Co., Ltd., Toronto

International Division: Milwaukee 1, Wisconsin

turing Co., which serves southern California, Arizona, and Utah. Mr. Cloran replaces A. A. FOMILYANT, who has been promoted to the position of general manager of the Nacnick Div. in Tulsa.

ALBERT V. SCHWARTZ has been elected assistant treasurer of Columbia Gas System Service Corp., New York. Succeeding him as supervisor of the methods department of East Ohio Fuel Gas Co., Columbus, is ROBERT J. FARLEY.

H. H. Holmes

R. G. Campbell

American Meter

American Meter Co. has announced several appointments. New sales engineers are R. G. CAMPBELL and H. H. HOLMES for the Los Angeles and western Oklahoma and Kansas territories, respectively. New members of the sales staff are ROBERT L. MCALISTER and JOHN T. HEFFERNAN, who will cover Washington, Oregon, and Idaho.

R. L. McAlister

J. T. Heffernan

American Meter

EARL F. BENNETT, former manager of the road materials section, has been appointed manager of the road and building materials section of the Tar Products Div., Koppers Co. Inc., and DR. J. N. ROCHE, formerly technical assistant to the division sales manager, has been named manager of the sales development section.

M. L. KAPP has been elected president of Interstate Power Co., Dubuque, Iowa, succeeding B. F. PICKARD, who was elected chairman of the board. Mr. Kapp has been executive vice president since 1949.

Southern California Gas Co., Los Angeles, has promoted ROGER C. LYON to the post of superintendent of distribution in the San Fernando Valley division and JOHN W. FAY to division accountant in the northeast division.

R. L. COLE has been made a vice president of Anchor Petroleum Co., Tulsa, and will continue to manage Anchor's western division.

Iroquois Gas Corp., Buffalo, N. Y., has elected STUART H. NICHOLS to the post of executive vice president. New vice presidents are HERBERT D. CLAY, chief engineer, and ROGER B. COBB, general superintendent.

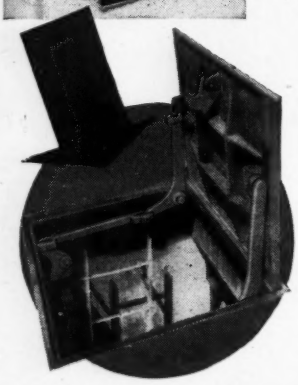
Several promotions have been announced in the sales department of Southern Counties Gas Co., Los Angeles. ROBERT M. MCINTYRE is now staff representative, market development; DONALD O. BURDICK is staff representative, new construction; JACK W. GRUBE is staff representative, commercial sales; and STANLEY J. LASSERE is commercial sales representative.

GEORGE P. HOUGH has been appointed general manager of the Permaglas-Heating Div. of A. O. Smith Corp. at Kankakee, Ill. He will continue his duties as an assistant to the president of A. O. Smith in the North Central region.

Newly created positions have been filled by Milwaukee Gas Light Co. E. UNGETHUEM is manager of plants; HOWARD KOWENSTROT is superintendent of area stations; H. W. VOHWINKLE, superintendent,

WACHS Safety Vault Covers

for Valve, Meter, Transformer and District Governor Vaults



Features

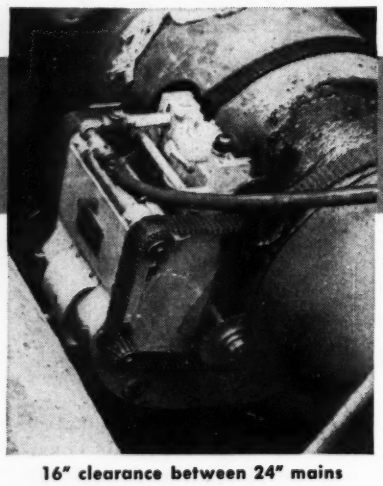
- One man can quickly raise cover with ease and without danger.
- Cover can not drop into vault or slam to cause injury or damage.
- Cover can be opened from the inside of the vault by one man—an added safety feature.
- Positive tamper proof lock that cannot be opened unless key is used.
- Open cover stands in upright position indicating that manhole is open.
- Unobstructed 30" square opening gives ample room for installation and servicing heavy equipment.
- Heavy duty for heavy traffic—cast iron frame and ribbed steel cover both machined for accurate fit to eliminate rattle.
- Moisture resistant, heavy cast steel levers and linkage with stainless steel pins in "Oilite" permanent oiled bronze bushings for long trouble-free service.
- Complete counterbalance structure protrudes less than 6" from the wall.

WACHS NATIONAL PIPE SAWS

Make Fast and Accurate Cuts on 10" to 48" Cast Iron and Steel Mains

Features

- Minimum Pipe Line down time.
- Cuts under water in flooded ditches.
- No broken pipe, milled cut.
- Thor Air-Powered, no flames near pipe.
- Set-up time about 15 minutes.
- Portable — weighs only 315 lbs. Two men can carry and set up unit.
- Small excavation—only 16" clearance needed.
- One machine cuts all pipe sizes from 10" to 48".
- Only two adjustments necessary for size changes.
- Cuts 24" pipe in 24 minutes — 36" pipe in 36 minutes, etc.



16" clearance between 24" mains

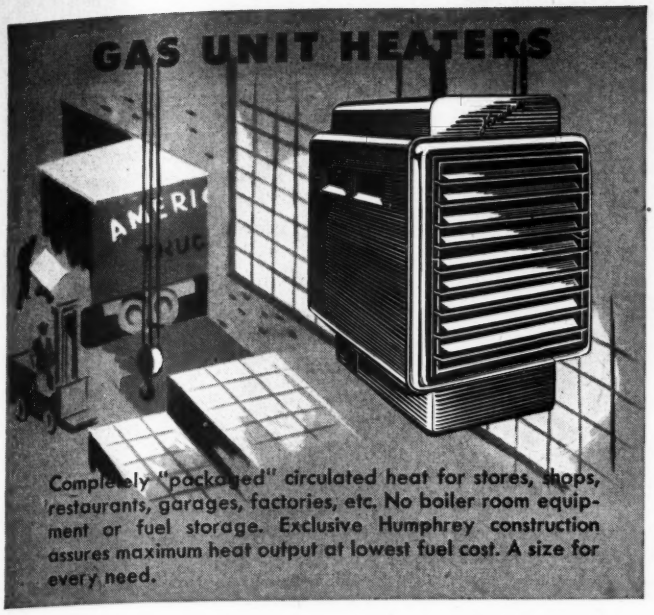
Write today for descriptive folder and engineering data on this new labor saving saw.

THE E. H. WACHS COMPANY

Manufacturers of Engines, Valves and Machinery since 1883

1525 NORTH DAYTON STREET · CHICAGO 22, ILLINOIS

GAS UNIT HEATERS



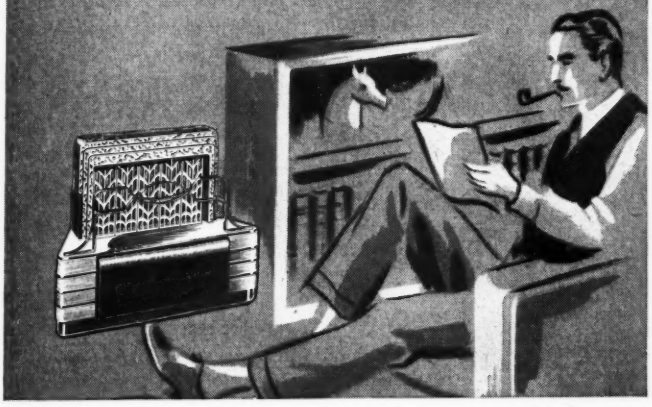
Completely "packaged" circulated heat for stores, shops, restaurants, garages, factories, etc. No boiler room equipment or fuel storage. Exclusive Humphrey construction assures maximum heat output at lowest fuel cost. A size for every need.

SELL *Humphrey* EQUIPMENT

for Top Styling... Performance and Economy

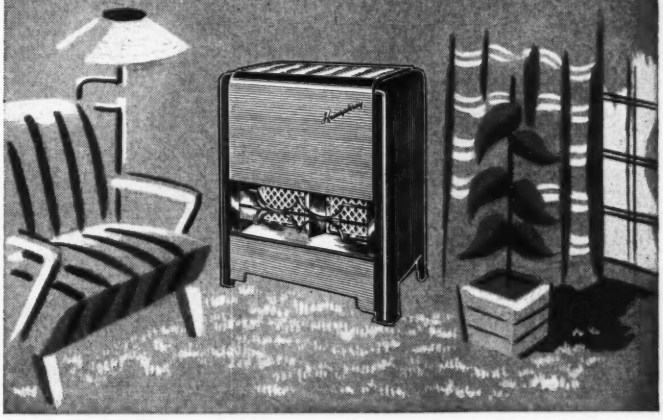
RADIANTFIRES

One of the most popular gas heaters ever made . . . abundant, satisfying heat with all the cheerfulness of an open fire. Available in vented and unvented models . . . manual or automatic operation.



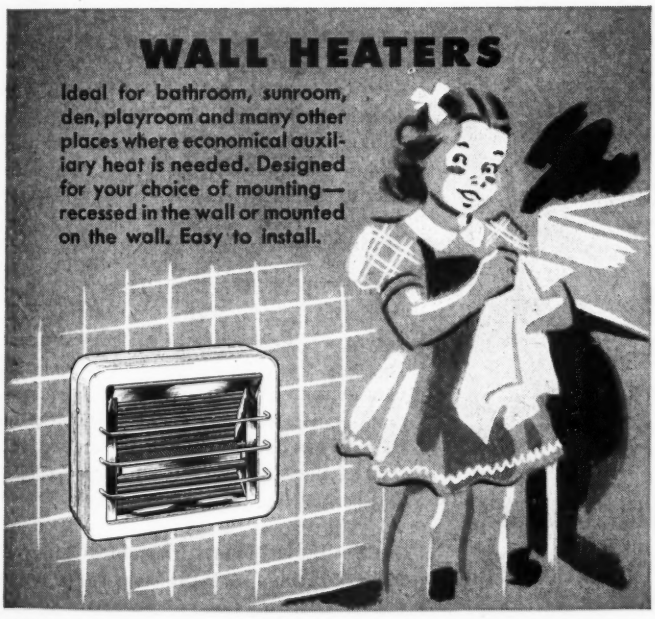
CIRCULATORS

Unsurpassed in ability to produce fast, clean heat . . . modern, beautiful styling . . . low cost operation. Two models . . . Open front Radiantfire Circulators and Closed front Royaline Circulators. Manual or automatic operation.



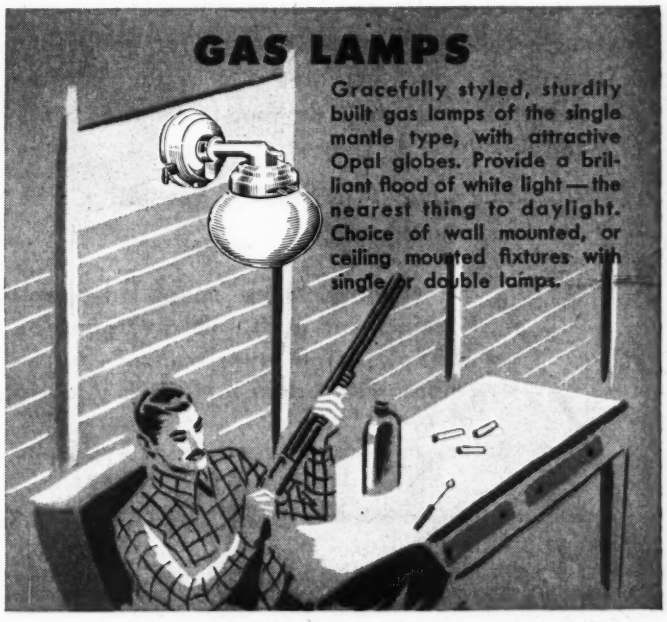
WALL HEATERS

Ideal for bathroom, sunroom, den, playroom and many other places where economical auxiliary heat is needed. Designed for your choice of mounting—recessed in the wall or mounted on the wall. Easy to install.



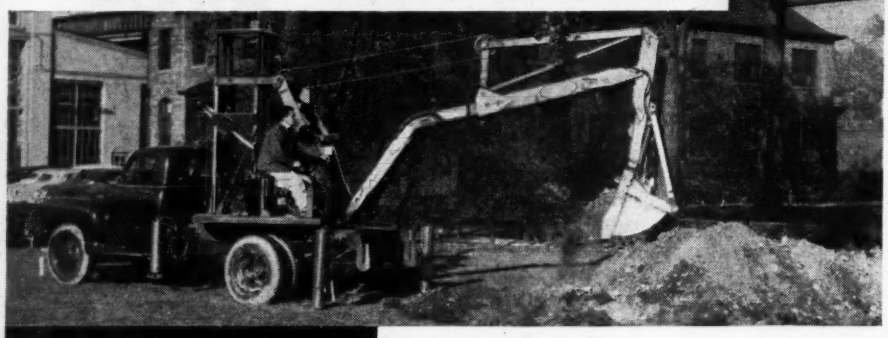
GAS LAMPS

Gracefully styled, sturdily built gas lamps of the single mantle type, with attractive Opal globes. Provide a brilliant flood of white light—the nearest thing to daylight. Choice of wall mounted, or ceiling mounted fixtures with single or double lamps.



GENERAL GAS LIGHT CO. • KALAMAZOO, MICHIGAN

A Money-Saving Crane-Hoe TEAM



Quick Boom Switch Means Easy Matching of Front-end to the Job!

Here the Hydrohoe digs a trench. By telescoping boom operator can peel off scallops at grade level — dig a smooth, even trench.

A quick switch and here's the Hydrocrane — setting gas line pipe. Telescoping boom permits reaching out without moving crane an inch.

Owners report switching Hydrocrane and Hydrohoe booms in less than an hour. This exceptional convertibility can save time — mean additional savings for you. For example, you can dig trenches or valve pits in the morning — convert to crane front-end — and set pipe or handle supplies in the afternoon.

With this quick, simple convertibility, the all-hydraulic Hydrocrane offers you 30H53

★ 50 mph. travel speed on open road
★ Quick-set hydraulic outriggers
★ Simple, hand lever control — no foot brakes
★ Telescoping boom that gives you eight extra feet of reach
★ Safety and exact precision of hydraulic operation

See your distributor for a demonstration. We will be glad to send you his name.

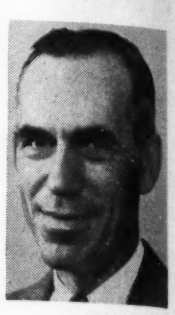
BUCYRUS-ERIE COMPANY

South Milwaukee, Wisconsin

west side station; NED VAHLDIECK, superintendent, distribution operations; and RAY JOCHIMSEN, assistant superintendent, distribution, construction and repair.

Ebasco Services Inc., New York, has named H. T. CANFIELD as assistant construction manager and W. C. STRATTON to the post of superintendent of design.

G. H. Baird
Cities Service



R. N. Campbell
AGE

GEORGE H. BAIRD, vice president, manager of operations, and director of Cities Service Gas Co., Oklahoma City, will retire on Nov. 1 after a lifetime in the field of natural gas transportation. He began his career as a meter inspector in 1916, serving successively as assistant and superintendent, meter department; division engineer; superintendent of operations; and division manager.

New faces

RONALD N. CAMPBELL has joined Affiliated Gas Equipment Inc. as assistant to the president. He will coordinate and plan AGE's production for the Bryant Heater, Payne, and Day & Night divisions.

JAMES D. KEARNS has joined the staff of the Z-Crete division of the Zonolite Co., Chicago, where he will contact architects, engineers, contractors, and Z-Crete applicators.

GLENN C. WILHIDE, recently retired from the U. S. Army, has joined Gar Wood Industries Inc. as manager of the Wayne (Mich.) division. He succeeds A. J. O'BRIEN, acting division manager, who will resume his duties as Gar Wood's vice president of manufacturing.

Transfers

CHESTER S. BEARD, an instrument engineer, has joined Foster Engineering Co., Union, N. J., as research and development engineer. Now in his second year as president of the New York section of the Instrument Society of America, Mr. Beard was in the past associated with Ebasco Services Inc., Bechtel Corp., Southern California Gas Co., and Permanente Metals Corp.

RICHARD F. DEAN has joined Rockwell Manufacturing Co., Pittsburgh, as supervisor of the company's employee relations and training program. He was formerly assistant

to the training director in the central staff of the industrial relations department of Koppers Co. Inc.

Honors

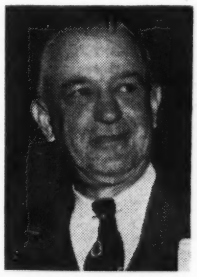
CLARK BELDEN, managing director of the New England Gas Assn., which has gained considerable acclaim for its public relations program, has been named to the public relations advisory committee of the U. S. Chamber of Commerce. The committee studies and advises on the Chamber's program from the standpoint of public interest.

MARSHALL NEWCOMB, general counsel for the Lone Star Gas Co., Dallas, was elected chairman of the mineral law section of the American Bar Assn. recently.

Deaths

HUGH H. CUTHRELL, 60, president and chairman of the board of the Brooklyn (N. Y.) Union Gas Co., died early last month. Prominent nationally in the gas industry for many years, Mr. Cuthrell had served as president of the AGA in 1949-1950, had been a member of the Gas Industry Advisory Council, and was a past president of the Society of Gas Lighting. In 1927 he joined Brooklyn Union as an engineer's assistant in the distribution department, filling various positions through the years until he was elected president in 1951 and chairman in 1952.

W. M. Kapus
Northwest Gas



Hugh Cuthrell
Brooklyn Union

WILLIAM M. KAPUS, long prominent in the gas and gas appliance industry in the Pacific Northwest, died recently at the age of 82. A native of Portland, Ore., Mr. Kapus organized the Northwest Gas & Electric Equipment Co. in 1908 and was president of the firm for 26 years. Previously, he had worked for the old Portland Gas Co. In 1920 he was elected president of the Pacific Coast Gas Assn. after having served as a director for several terms. He was also an active member of the AGA.

JERRY S. SHEARER, 60, treasurer of Southwestern Development Co., New York, died Aug. 25 after a long illness. He was also treasurer of each of Southwestern's six subsidiary natural gas companies operating in West Texas and New Mexico, including West Texas Gas Co. and Amarillo Gas Co.

FRANK J. HAAS, 76, former vice president and general manager of Southern Indiana Gas & Electric Co., Evansville, died in August.

THE PREFABRICATED PROTECTIVE COATING

FAST, SAFE, ECONOMICAL

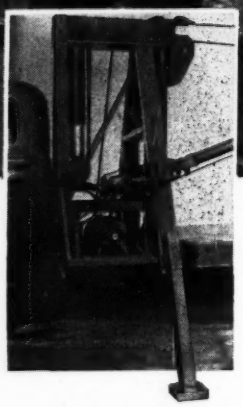
ARE YOU GETTING ALL THESE ADVANTAGES NOW

- Coating material of plasticized coal tar enamel or filled asphalt enamel.
- Reinforcement of woven glass textile fabric.
- Strip separator sheet to prevent sticking in rolls regardless of temperatures.
- Excellent bond to adjacent coating and pipe.
- Conveniently applied to full 3/32 inch thickness.
- No waste of bituminous material.

WRITE TODAY FOR A FREE DESCRIPTIVE FOLDER.

PROTECTO WRAP CO.
ENGLEWOOD, COLORADO

Want to handle pipe CHEAPER?



You CAN...with this new truck-crane

PITMAN

HYDRA-LIFT

Mount a Pitman Hydra-Lift on one of your trucks and with this single piece of equipment, you can handle pipe faster and cheaper than you can with the *two or more* pieces of equipment you are now using!

How? With its swinging boom, Hydra-Lift loads pipe directly onto a trailer pulled by the same truck on which Hydra-Lift is mounted. The truck and trailer then move to the job site at normal truck speeds. At the job, Hydra-Lift is right there, ready to swing the pipe off the trailer, then lay it in the ditch. How many pieces of equipment are you tying up to do this work now?

Hydra-Lift mounts on almost any truck; two tons or larger recommended. Hydraulic power swings the boom 180°, lifts it through an arc of 100°. Boom telescopes from 12 to 17 to 22 feet. Loadline capacity up to 6400 pounds. Yet Hydra-Lift requires but 40 inches behind your truck cab. *Hundreds* of Hydra-Lifts are being used by contractors and utility companies all over the country to cut pipe handling costs!

MAIL THIS COUPON TODAY FOR FULL INFORMATION!

Pitman Mfg. Co.,
300 West 79th Terrace
Kansas City, Mo.

Please send me more information about the low-cost Hydra-Lift.

Name.....

Address.....

City.....State.....

CALENDAR

October

2..SGA Right-of-Way Conference — Peabody Hotel, Memphis.

6-7..Texas Mid-Continent Oil & Gas Assn. — Rice Hotel, Houston.

6-7..AGA-EEI Electronic Symposium — Hotel Commodore, New York.

7-9..NACE South Central Region — Mayo Hotel, Tulsa.

12-16..NACE Short Course on Cathodic Protection — University of Illinois, Urbana.

15..NEGA Operating Division — Hotel Kimball, Springfield, Mass.

16..SGA Transmission Accounting Conference — Rice Hotel, Houston.

19-21..35th Annual Meeting, American Standards Assn.—Waldorf-Astoria, New York.

19-23..National Metal Exposition—Public Auditorium, Cleveland.

19-23..National Safety Council — Conrad Hilton, Congress, Morrison, and Sheraton hotels, Chicago.

20..NEGA Accounting Division—The Sheraton-Biltmore, Providence, R. I.

26-28..AGA Annual Convention — Kiel Auditorium, St. Louis, Mo.

27..Institute of Gas Technology Annual Meeting — Chase Hotel, St. Louis.

November

5..NEGA Safety Conference — Hotel Statler, Boston.

6..SGA Residential Sales East Conference — W. R. Barringer Hotel, Charlotte, N. C.

9-13..API — Conrad Hilton and Palmer House, Chicago.

9-13..National Hotel Exposition — Kingsbridge Armory, New York.

11-13..Wisconsin Utilities Assn. — Hotel Schroeder, Milwaukee.

13..SGA Residential Sales West Conference — Adolphus Hotel, Dallas.

17-20..NACE Western Region Fall Conference — Biltmore Hotel, Los Angeles.

18-20..Mid Southeastern Gas Assn. —Sir Walter Hotel, Raleigh, N. C.

29-4..American Society of Mechanical Engineers — Statler Hotel, New York.

December

1-4..University of Oklahoma Corrosion Conference — University of Oklahoma, Norman.

9..NEGA Appliance Servicing Conference — Hotel Statler, Boston.

1954

March

4-5..AGA Transmission and Storage Conference — Jung Hotel, New Orleans.

15-17..Mid-West Gas Assn.—Fort Des Moines Hotel, Des Moines, Iowa.

25-26..Oklahoma Utilities Assn. Annual Meeting — Biltmore Hotel, Oklahoma City.

25-26..New England Gas Assn. — Hotel Statler, Boston.

April

12-14..AGA Sales Conference on Industrial & Commercial Gas — Edgewater Beach Hotel, Chicago.

12-14..National Conference of Electric & Gas Utility Accountants—Hotel Statler, Boston.

13-15..Oklahoma Utilities Assn. Southwestern Gas Measurement Short Course — University of Oklahoma, Norman.

20-23..AGA Distribution, Motor Vehicles, and Corrosion Conference—Mount Royal Hotel, Montreal, Canada.

22-23..Indiana Gas Assn. Annual Meeting. French Lick Springs Hotel, French Lick, Ind.

26-28..Mid-West Regional Gas Sales Conference — Edgewater Beach Hotel, Chicago.

26-28..Southern Gas Assn. Annual Convention—Houston.

May

10..AGA Commercial Gas School — Chicago.

9-12..LPGA Convention — Conrad Hilton Hotel, Chicago.

19-21..GAMA Annual Meeting — The Drake Hotel, Chicago.

24-26..AGA Production and Chemical Conference — William Penn Hotel, Pittsburgh.

27-28..Natural Gas & Petroleum Assn. of Canada — Prince Edward Hotel, Windsor, Ontario, Canada.

"YES! We made HEATH Leakage Control Surveys of some 500 gas properties during 1953."

"YES! ... they were more than pleased with the results ... especially with the reports as to *accuracy* of leak locations and the *classification* as to size and importance."

"YES! ... that neighboring Gas Company was one of the 500 and we certainly appreciate their telling you about our work and recommending us so highly."

"YES! ... they agree that nothing but the *best* will do when it comes to AUDITING your Gas Leakage conditions."

"YES! ... I certainly advise you to use our Over-All Heath Leakage Control Survey ... especially if, up to date, you may have been using only *one phase* of our complete Survey Service."

You too can save thousands of dollars worth of gas annually ... reduce insurance problems by reducing hazards ... improve public relations and safety conditions. Decide *today* to have a Heath Leakage Control Survey on your property!

You Can't Sell Gas that Leaked Out!

HEATH

Leakage Control Surveys

Write, Wire, or Phone for Complete Information

HEATH SURVEY CONSULTANTS, INC.

572 Washington Street, Wellesley 81, Massachusetts

Midwestern Office—Richmond, Michigan

Give yourself the

Unbeatable Performance of the RIDGID Heavy-Duty Pipe Wrench

Every RIDGID Wrench Factory-Tested

That's what makes sure that every RIDGID performs as you've learned to expect... *every* part inspected, *every* wrench pipe tested 100%! Only RIDGID's housing is unconditionally guaranteed, saving you bother and expense. Full-floating hookjaw, adjusting nut spins easily in all sizes, 6" to 60"; replaceable alloy jaws, handy pipe scale on hookjaw, comfort-grip I-beam handle. For most service for your money, buy RIDGID's . . . at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO, U.S.A.

RIDGID
Work-Saver Pipe Tools

ASSOCIATIONS

Lab construction program under way in Cleveland

Completion of new administrative and clerical offices in the recently erected south wing addition to the AGA Laboratories at Cleveland is scheduled for late this year. Work on the $115,000 project got under way in mid-August.

The relocation of the administrative offices on the second floor of the south wing addition will provide for further expansion of the Lab's facilities for the administration of the appliance approval program and the conduct of research on gas appliances and accessories under the AGA's PAR program.

The administrative section will have an enlarged committee meeting room for use by the gas industry, and space for the Lab's library. Office space will be provided for Director Edwin L. Hall and his staff, as well as for the accounting, stenographic, and standards sections. Improved storage facilities for publications and office supplies together with a general conference area for the staff will be provided in the center area of the second floor south wing.

Gas division of Oklahoma Utilities Assn. meets

Members of the gas division of the Oklahoma Utilities Assn. met for their fall conference at the Biltmore hotel in Oklahoma City on Sept. 18.

The one-day program featured speakers and subjects of wide interest, including a showing of the Southern Gas Assn. film "Natural Gas" with comments by R. R. Suttle, managing director of the SGA.

Other speakers and their subjects were L. A. Farmer, Northern Oklahoma Gas Co., Ponca City, "Problems Facing the Gas Industry"; Frank C. Smith, AGA and Houston Natural Gas Corp. president, "The Year and the Task"; Julia Hunter, Lone Star Gas Co., Dallas, "One Woman's Word"; C. B. Day, Consolidated Gas Utilities Corp., Oklahoma City, "Need of Increased Efficiency in Operation"; and E. Carl Sorby, Geo. D. Roper Corp., "What Are Your Curiosity Arousers?"

CNGA program of interest to gas industry members

Two symposia of interest to the gas industry will be included on the program of the annual fall meeting of the California Natural Gasoline Assn. to be held Oct. 8-9 at the Ambassador hotel in Los Angeles.

N. K. Senatoroff, Southern Counties Gas Co., will be the discussion leader of the symposium on gas dehydration in the gas gathering forum. It will feature talks on "Operation of Dehydration Plant" by J. A. Gordan, Union Oil Co.; "Special Problems

of Gas Dehydration" by R. J. Hull, California Research Corp.; and "Low and High Temperature Effects on Dehydration" by Arnold L. Johnson, Shell Oil.

In the second forum on compressors and engines a symposium on boiling point cooling systems will have Gordon Jackson, Drayer-Hansen Co., speaking on "Boiling Point Cooling Systems"; O. B. Freeman and Richard Blank, Tide Water Associated Oil Co., on "Cylinder Wall Temperatures"; Ed Blossom, Signal Oil & Gas, on "L. O. Coolers, Sizing, and Selection"; and Monty Stone, Long Beach Oil Development Co., "External Temperature and Rate Circulation."

Other forums on laboratory techniques, development and research and on plants and processing will also be held. Scheduled is a talk by Harold P. Huls, California Public Utilities Commission, on "The Relationship of Public Utility Regulation to the Natural Gas Industry."

T. T. Arden

Sheldon Coleman

GAMA will install officers during AGA convention

In conjunction with the annual convention of the AGA, the Gas Appliance Manufacturers Assn. will hold a board of directors meeting in St. Louis on Oct. 25. New and retiring officers will attend and all chairmen of product divisions have been invited.

New officers will assume their duties at the conclusion of the convention on Oct. 28. They are Sheldon Coleman, Coleman Co., president; T. T. Arden, Grayson Controls Div., 1st vice president; W. F. Rockwell Jr., Rockwell Manufacturing Co., 2nd vice president; and Lyle C. Harvey, Affiliated Gas Equipment, treasurer.

New division chairmen, who will also become members of the board, are: W. T. Trueblood Jr., domestic gas ranges; Harold

W. F. Rockwell Jr.

Lyle Harvey

The vise that's a handy portable workbench

RIDGID

New No. 40 Tristand Pipe Vise

Easily taken to the job—legs fold in and chain for carrying, tray quickly on and off. Roomy top has pipe rest and efficient benders; tray keeps tools handy—and also makes Tristand extra rigid, won't fold up in use! Tool-steel Longrip jaws—firm grip but easy on polished pipe and tubing. Yoke No. 40, (old TSY-2½) 2½"; chain No. 45 (old TSC-4) 4". Buy these handy worksavers at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO • U. S. A.

RIDGID
Work-Saver Pipe Tools

THE NORMAC BELL JOINT CLAMP

A SIMPLE SOLUTION for one of the GAS INDUSTRY'S *most trying problems*

Solves Your Joint Repair Problems • Quick • Easy • Permanent

Installed in small pavement openings. Available in all standard sizes from 3" to 12". A simple set of tools cleans the joint, installs the clamp . . . often in only a quarter of an hour. SAVES TIME. SAVES MONEY and the repair is permanent. Designed for all conditions particularly where pavement repair costs are prohibitive. Such small opening repairs are scarcely noticeable when pavement is replaced.

Normac Clamps can be installed in large as well as small openings.

Norton-McMurray hold definite leadership in the development of methods for installation and rehabilitation work through small openings. We welcome the opportunity to help solve a problem you may have—tell us about it.

Write for our catalog describing our complete line of

COUPLINGS . . . FITTINGS . . . SERVICE TEES and ELLS . . . SLEEVES . . . COMPRESSION-END COCKS . . . METER BARS and BRASS FITTINGS for copper pipe.

6 inch Normac Clamp being lowered into hole for installation

6 inch Normac Clamp in service after installation

NORTON-McMURRAY MFG. CO.

122 SOUTH MICHIGAN AVENUE • CHICAGO 3, ILLINOIS

Method and product covered by U. S. Patents, Nos. 2,163,261 and 2,178,286.

C. Day, househeating and air conditioning equipment; H. B. Carbon, gas water heaters; Robert D. Smith, gas incinerators; D. E. DuPerow, gas valves; Frank H. Post, automatic controls; Thomas D. Bromley, direct heating equipment; George B. Horne, relief valves; F. C. Schaefer, industrial gas equipment; Wendell M. Smock, hotel, restaurant and commercial gas equipment; Frank J. Kern Jr., gas regulators; John Christensen, gas clothes dryers; and Gilbert T. Bowman, gas meters and regulators.

Nine divisions are scheduled to meet during the 3-day AGA convention. They are automatic controls, appliance regulator and gas valve divisions, gas water heaters, househeating and air conditioning, meter and regulators, domestic gas ranges, direct heating, and conversion burners.

Busy days planned for AGA convention attendants

Three activity-packed days have been planned by the general convention committee for the 35th annual convention of the American Gas Assn., meeting at the Kiel auditorium in St. Louis on Oct. 26-28.

The first general session, Monday morning, Oct. 26, will feature a talk by FPC Chairman Kuykendall, who will tell about his "Five Months as Chairman of the Federal Power Commission." His talk will be preceded by reports from the outgoing president, Frank C. Smith, and Edward F. Barrett, treasurer.

Another general session speaker will be Eugene S. Loughlin, president of the National Assn. of Railroad & Utilities Commissioners and the Connecticut PUC, speaking on "States' Rights—Its Privileges and Responsibilities." Presentation of awards will also highlight the Tuesday morning session.

Gas industry movies will be shown in the Opera House of Kiel auditorium every morning preceding the general sessions.

An important part of the operating section's meeting will be a panel on overpressure protection, which will have John M. McCaleb, Columbia Gas System Service Corp., as moderator. Panel members are Gordon G. Dye, Southern California Gas Co., shutoff devices; Earl N. Armstrong, Transcontinental Gas Pipe Line Corp., monitor regulators; Donald J. Miller, Public Service Co. of Colorado, mechanical relief devices; and Henry W. Parker, Lehigh Valley Gas Div., oil seals.

Also on the program of the operating section are talks by W. H. Krammes, Southern California Gas Co., on "Applications of Fire Control and Slug Purge for Pipeline Maintenance"; D. E. Noble, Motorola Inc., on "Electronics—A Tool for Communications and Control in the Gas Industry"; and Charles W. Studt, Union Gas System Inc., on "The Acquisition of Underground Gas Storage Rights." A panel discussion will be held on "Operating Problems of the Smaller Gas Company."

F. M. Partridge, Southern California Gas Co., will speak on "Progress in Large Volume Measurement"; S. A. Chadwell, Columbia Gas System Service Corp., on "Load Dispatching"; R. O. Babcock, Consolidated Edison of New York, on "Leasing of Automotive and Mobile Equipment"; Hugh L. Hamilton, A. V. Smith Engineering Co., on "Coordination of Corrision Control"; John F. Eichelmann, El Paso Natural Gas Co., on "Gas Turbine Driven Centrifugal Compressors for Gas Transmission."

The accounting, industrial and commercial gas, and residential gas sections will hold their meetings, as will the corporate secretaries, insurance, general management, and rate committees. The home service breakfast is scheduled for Tuesday morning and will be followed that afternoon by the home service roundtable.

Social affairs on the agenda are the ladies'

Incoming officers of the AGA, as pictured on page 110, are as follows:

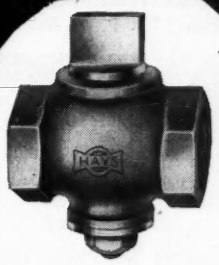
Officers: E. H. Eacker, Boston Consolidated, president; F. M. Banks, Southern California Gas, 1st vice president; Dean H. Mitchell, Northern Indiana Public Service, Hammond, 2nd vice president; Vincent T. Miles, Long Island Lighting Co., treasurer.

Directors: F. T. Parks, Public Service Co. of Colorado; B. C. Adams, Gas Service Co.; Sheldon Coleman, Coleman Co.; H. C. Cummins, Northern States Power Co.; D. E. Karn, Consumers Power Co.; W. H. Ligon, Nashville Gas Co.; J. F. Donnelly, Servel Inc.; John E. Heyke Jr., Brooklyn Union; J. K. Horton, Pacific Public Service Co.; A. W. Lundstrum, Ohio Fuel Gas; J. Theodore Wolfe, Consolidated Gas Electric Light & Power Co.; L. L. Baxter, Arkansas Western Gas; Frank Austin Brownie, Canadian Western Natural Gas; M. A. Abernathy, United Gas Pipeline; L. B. Richards, Harrisburg Gas Div.

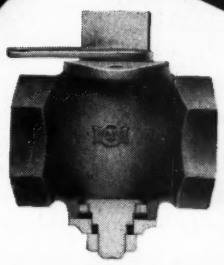
Section chairmen: Paul E. Ewers, Michigan Consolidated, accounting; Charles C. Eeles, Ohio Fuel Gas, industrial and commercial gas; Frederick J. Pfluke, Rochester Gas & Electric, operating; Raymond Little, Equitable Gas, residential gas; Lovett C. Peters, general management.

Section vice chairmen: A. T. Gardner, Delaware Power & Light, accounting; Ray Trowbridge, Seattle Gas Co., industrial and commercial gas; W. H. Davidson, Transcontinental Gas Pipe Line, and J. H. Collins, New Orleans Public Service, operating; Walter H. Kurdelski, Michigan Consolidated Gas, residential; Howard B. Noyes, Washington Gas Light, general management.

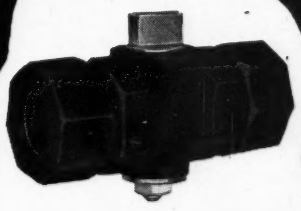
IT PAYS TO BUY HAYS that are TOPS



7405
Iron Body, Galvanized, Bronze Plug Stop



7490
"Key-Lok" Tamper Proof Stop Lockwing—Iron Body, Bronze Plug



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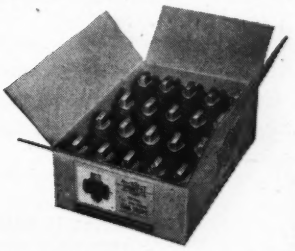

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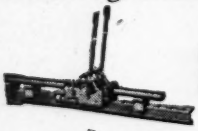

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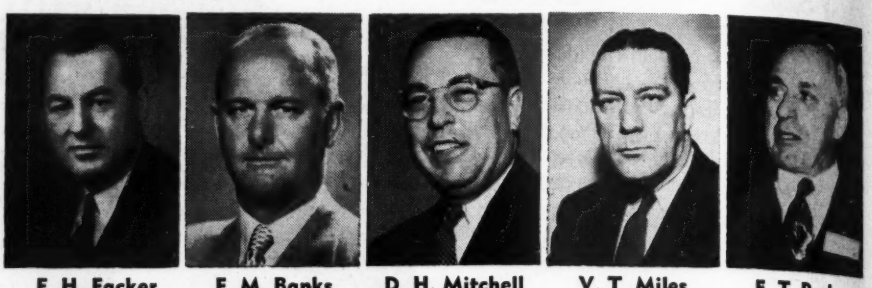
(See page 108-109 for offices and story)



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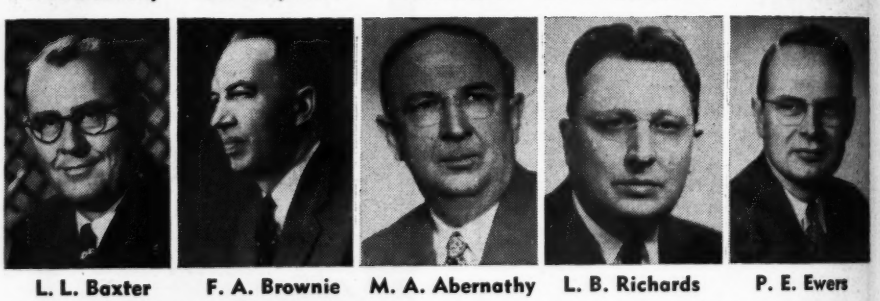

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R. Trowbridge | F. J. Pfluke | W. H. Davidson | H. B. Noyes | A. T. Gardner

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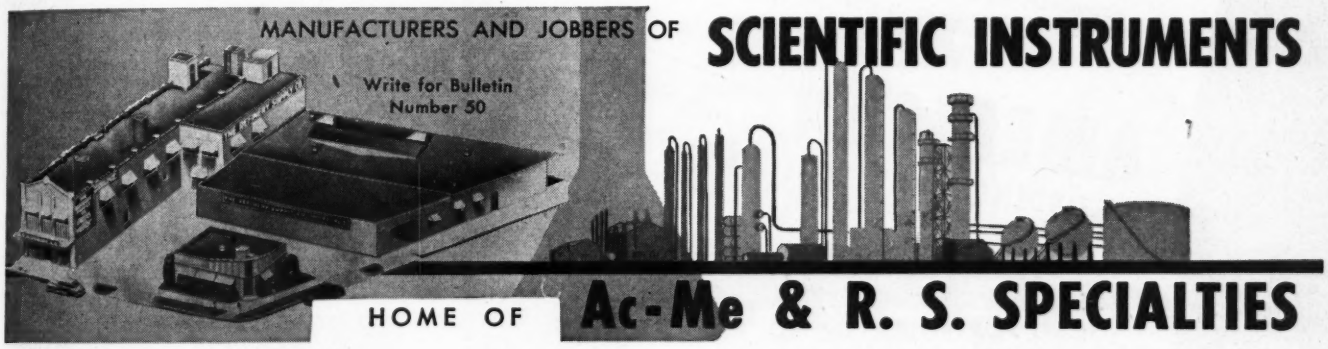

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party on Monday afternoon in the Starlight Roof of the Chase hotel and the president's reception, entertainment and dance on Tuesday night in the Gold room of the Hotel Jefferson.

Close to 1000 gather for PCGA's 60th convention

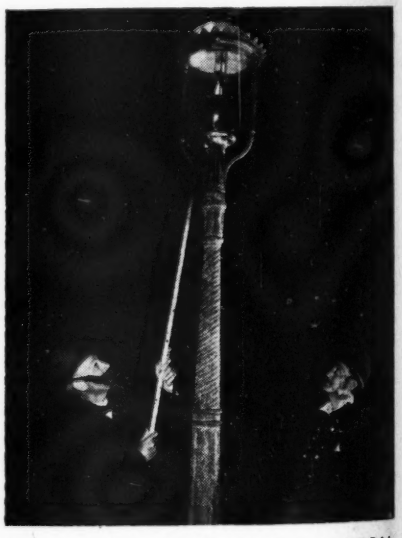
Nine hundred and forty gas folk and their wives, reliving in costume and atmosphere the days of the last century but keeping a keen business eye on the present and future, helped the Pacific Coast Gas Assn. celebrate a twin event last month—the 60th (diamond jubilee) convention of the association and the 100th year of gas service on the coast.

The clock was turned back on San Francisco's Nob Hill every eve, from Sept. 9 to 11, with nostalgic lamp-lighting ceremonies in front of the two hotels hosting the convention, and with the "Gay Nineties Review" on the night of Sept. 10, when virtually the entire delegation turned out in period costumes for the event. President and Mrs. James Moulton were transported by horse-drawn carriage from one hotel to the other for the evening—a distance (by direct route, which was not taken) of some 100 feet.

The old-time theme was also injected into the business sessions, with a skit "It Started One Hundred Years Ago—" opening the second general session.

The serious business of thinking about today's and tomorrow's problems was highlighted by the address of California's new senator, Thomas H. Kuchel (appointee for the post vacated by Vice President Nixon), who narrowed his scheduled address on "The State of the Union" to a searching examination of government fiscal policies. Senator Kuchel was introduced by Actor George Murphy, Republican party wheelhorse in California.

The availability of large amounts of un-



Every evening at dusk during PCGA's convention, a costumed lamplighter fired up the gas lights in front of the headquarters hotels in San Francisco.

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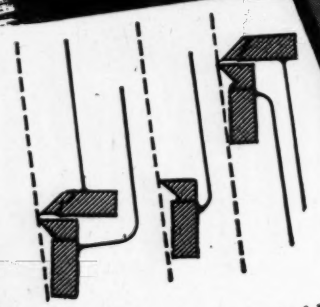

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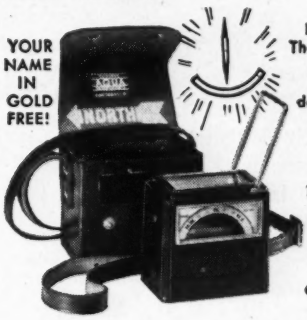

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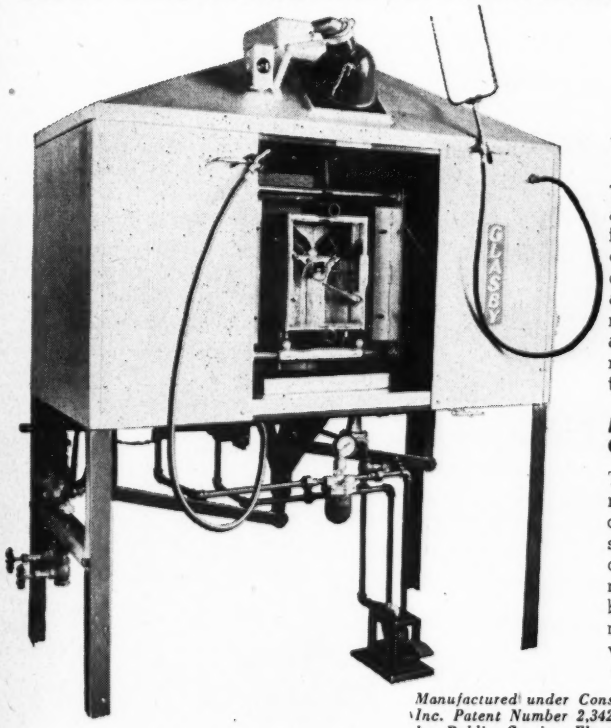

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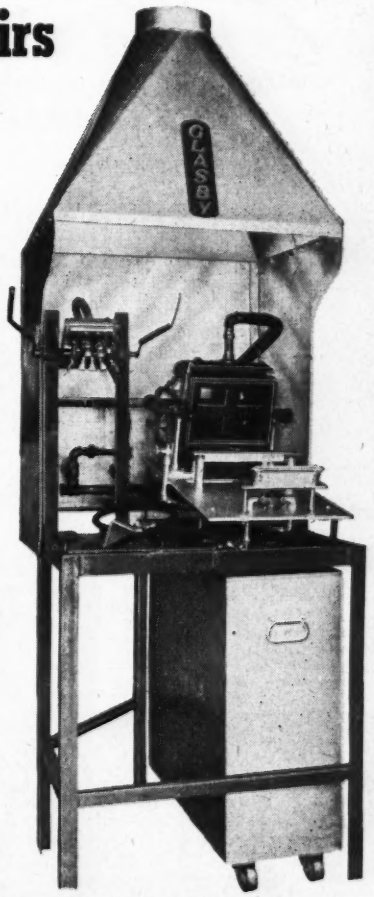
Meter Top and Valve Box Cover Removing Machine →

This machine facilitates the removal of meter tops and valve box covers to minimize the time-consuming problems of meter repair operation. Available in 5 light meter and 10 light meter sizes, both adjustable to most makes of meters. Both models feature devices for the safety of the operator.



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Signaling start of PCGA's Gay Nineties Review, old and new presidents James Moulton (left, front) and W. C. Mainwaring gather with costumed delegates on the hotel steps.

expended appropriations for future use was stressed by the senator to establish the soundness and adequacy of the reduced federal budget—especially as it affects national defense and the air force. Mr. Kuchel pointed out that for all governmental departments and agencies there remains a backlog of $140 billion for future use.

Closer year-to-year control of these funds by Congress is being urged in a bill he is jointly sponsoring with Senator Harry Byrd (D.-Va.), the senator said.

In the realm of the gas business, packed sessions heard from AGA President Frank Smith, who made a strong plea for unity among the sectors of the gas business; Gene Martin, vice president of Carl Byoir and Associates Inc., reporting on the rapid and substantial progress in the GAMA public relations program, which his firm handles; GAMA President James F. Donnelly, who cited progress in promotion of gas appliances; Dean H. Mitchell of Hammond, Ind., chairman of the gas industry development committee, explaining the operation of the action program.

Safety talks, employee relations reports, cost control studies, a graphic talk on petrochemicals, and a home service breakfast and program that attracted turn-away crowds filled in the well-rounded program.

Honors in the form of awards went to Robert Brooks, PG&E Co., winner of the Gold Medal for his paper on "Specific Heats Data," with honorable mentions to N. K. Senatoroff, Southern Counties, and Elting Henderson, Southern California Gas Co. R. D. MacMahon, Southern Cal, as chairman of the sales and advertising section, was awarded the Basford trophy.

Government fiscal policy was examined by California's new senator, Thomas H. Kuchel, before a packed PCGA luncheon.

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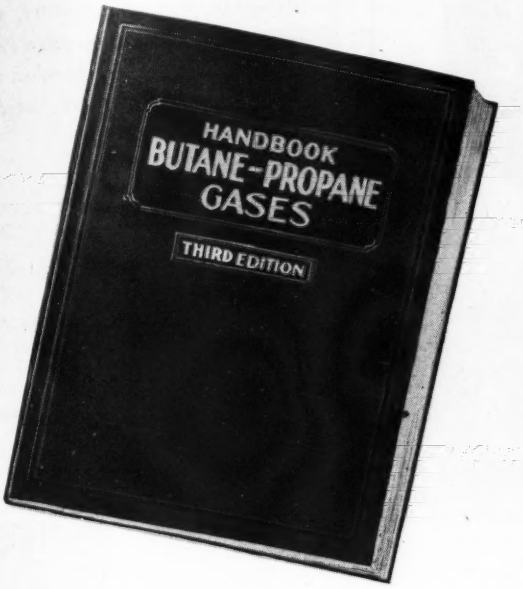

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Analytical Determination and Testing
Fire Protection and Control

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Bottled Gas Systems
Gas Utility Service from Central Plants
Multiple Utility Service from a Central Plant

PART 6. Utilization of L. P. Gas
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Commercial Applications
Industrial Applications
Enrichment, Peak Load, and Standby Uses
A Fuel for Internal Combustion Engines

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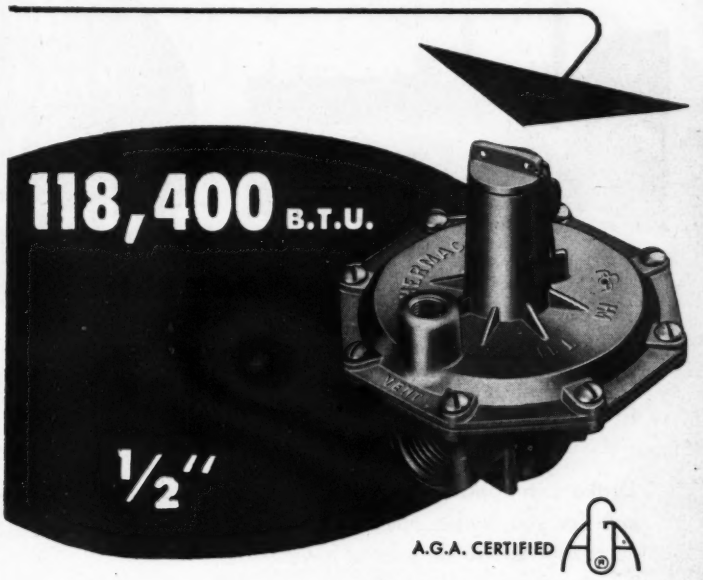

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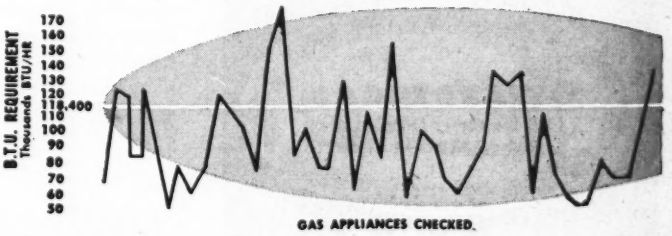
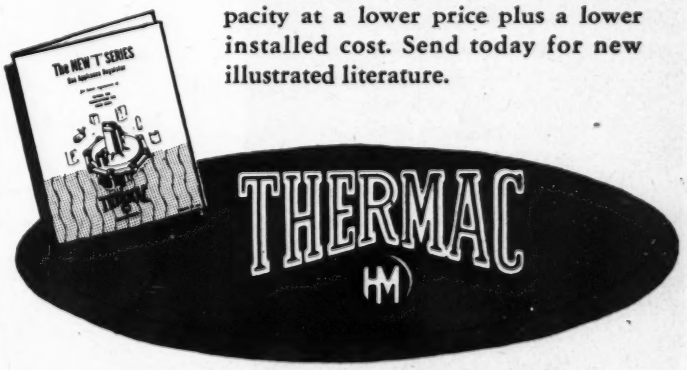
Scores of appliances produced by American manufacturers as charted below actually determined the specific sizes of our various models. In other words, we built a regulator to meet appliance requirements, something seldom done.



The octagonal shape makes installations in tight spots a cinch. We have also added vise grip bosses to aid assembly. Then too, the cover vent may be tapped to receive your particular connection thereby eliminating need for extra fittings. In the new "T" series you have a small regulator with more capacity at a lower price plus a lower installed cost. Send today for new illustrated literature.



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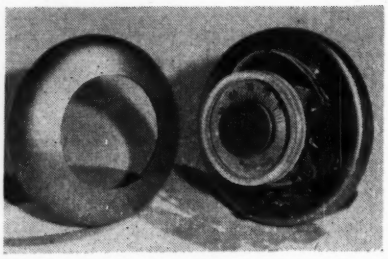


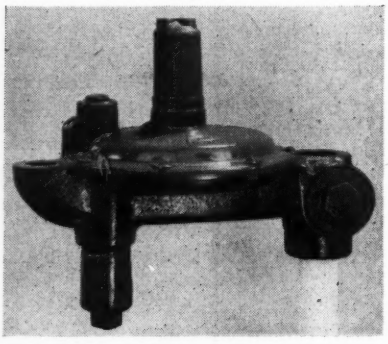
1 Round Thermostat

The first major change in thermostat appearance since the first bi-metal control was introduced is claimed by Minneapolis-Honeywell's new round thermostat, which is actually in the shape of half a sphere. Styled by Industrial Designer Henry Dreyfus, the new model will become the company's standard thermostat for home use.

In addition to its decorative features (it may be papered or painted to match wall color), the new thermostat incorporates a sensitive low voltage non-magnetic mercury switch, a bi-metal actuated thermometer, an adjustable temperature control range with stops, a fixed differential, and an adjustable heater for improved time modulation operating characteristics.

Minneapolis-Honeywell Regulator Co.

■



2 Mercury Seal Regulator

A new mercury seal version of Rockwell's standard 107-1 service regulator has been designed to relieve larger volumes of gas in emergencies. The modified "107-1" is being produced as a result of the revision of many utility safety codes.

Separate mercury seals adaptable to 107-1, 107-2, and 107-3 service regulators already in service are also available. Dimensions of the new regulator are the same as those of the 107-1 except for the mercury well and vent, which are slightly larger than the inlet chamber and vent of the 107.

Rockwell Manufacturing Co.

■

3 Gas Incinerator

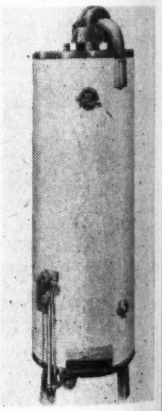
Three models are available in the new Cribben & Sexton gas incinerator, the Consum-All: 1½- and 2½-bushel sizes, fully automatic, and 1½-bushel with safety pilot for manual operation.

According to the manufacturer, the cylindrical design not only is a space-saving feature, but the absence of corners provides advantages in the burning operation, an important one being the elimination of clogging. The 37-in. high incinerator features a firebrick lining, which in its manufacture has been subjected to over 2000° F, far higher than it will meet in service. White silicone finish is featured.

Cribben & Sexton Co.

■

4 Dual Purpose Water Heater



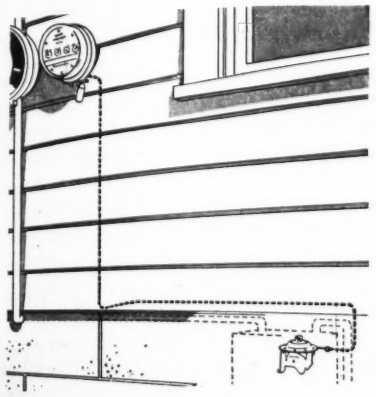
The dual purpose "Water-Air"—automatic gas water heater and space heater combination—is being manufactured by Handley-Brown Heater Co. It provides ample hot water and heated air as well and can be used for dehumidification of damp basements, augmenting central heating systems, supplying garage heat or meeting farmers requirements in the milkhouse.

Its reverse air flow principle provides

maximum exchange of tank heat. Air travels around the entire tank from bottom air inlet to the tank top. It is then blower driven down through the internal flue to the heat exchanger, which is directly over the 25,000 Btu burner. Standard duct size outlet for heated air at the bottom of the unit provides for simple duct arrangement if heat is desired in another location.

Handley-Brown Heater Co.

■



5 Gas Telemeter

A pneumatic device has been developed by Sangamo Electric Co. that permits exact outdoor reading of the index of existing inside-installed gas meters. This development can speed meter reading, reduce expense for the company, and eliminate both "skips" and the practice of rendering estimated bills.

The Sangamo gas telemeter repeats exactly the position of the hands of the gas meter index, but at an outside location, permitting remote reading of the index.

At the present time, the Sangamo gas telemeter's application is confined to tin case gas meters to which it becomes an adjunct. The index of the meter on the inside continues to operate precisely as it did originally, but its reading is duplicated on the index of the telemeter on the outside. Each 100 cu ft of gas registered on the index of the meter will cause the telemeter index to advance one count on its clock-type dial, exactly as on the gas meter proper.

The Sangamo gas telemeter consists of two units: one is the telemeter index instrument, the other the telemeter transmitter element. These two units are pneumatically connected by a small copper tube. The telemeter index instrument is mounted on the outside of the house with one end of the copper tubing connected thereto and penetrating the wall to the gas meter. The telemeter transmitter element is mounted inside the meter; the other end of the copper tubing connects to this unit.

Here is how it operates: A gear arrangement on the telemeter transmitter meshes with the gear on the proving circle axle which actuates the regular meter index. This is the source of power for driving the transmitter.

The major operating components of the transmitter consist of a small gear drive, a

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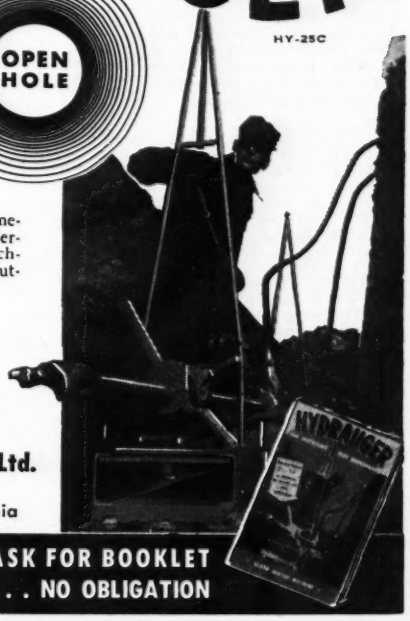

*Earth Boring Tool

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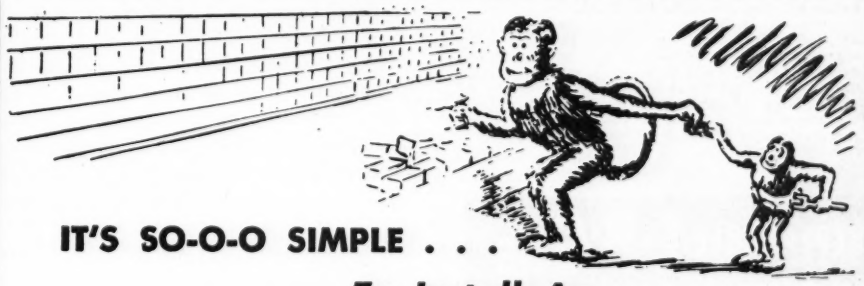

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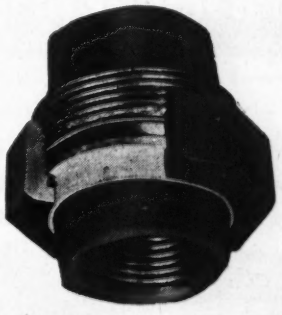

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GAS ENGINEER. Growing natural gas company located in north central area has opening for gas engineer experienced in preparation of material for presentation before regulatory bodies and in natural gas transmission or distribution operations. Salary commensurate with ability and experience. Replies confidential. Write Box 40, GAS, 198 S. Alvarado St., Los Angeles 57, Calif.

GRADUATE ENGINEER. Growing natural gas company located in north central area has opening for recent graduate for engineering work in connection with natural gas transmission and distribution operations. Some experience in field but not essential. Salary commensurate with ability and experience. Replies confidential. Write Box 45, GAS, 198 S. Alvarado St., Los Angeles 57, Calif.

FOR SALE: 1—22" x 54" high pressure Roots-Connersville meter with P.V.T.T. recorder. Displacement 36.7339 cu. ft. — displacement per hr. 359,000 cu. ft. at normal speed and 538,000 cu. ft. at peak of 244 R.P.M. Maximum working pressure 45#. Discontinued account going to higher pressures. Write Box 50, GAS, 198 S. Alvarado St., Los Angeles 57, Calif.

POSITION WANTED by graduate engineer with five years experience in design, construction, maintenance and operation of natural gas distribution systems. Now Distribution Superintendent for small system. Write Box 60, GAS, 198 S. Alvarado St., Los Angeles 57, Calif.

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cam, and a diaphragm. The gear drive rotates the cam, causing the diaphragm to pulsate once for the passage of each 100 cu ft of gas. The pulsation of the diaphragm in the transmitter sets up a pneumatic pressure which is transmitted through the copper tube to the index instrument, or the receiver. The components of the receiver consist of a diaphragm, a ratchet-type advance, and an index mechanism.

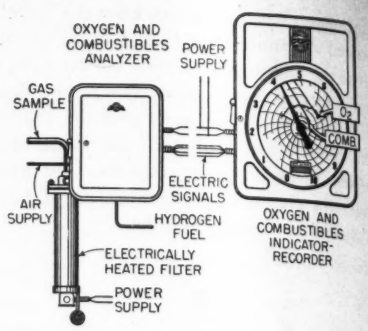
The pulsation of the diaphragm of the transmitter results in a corresponding pulsation of the diaphragm of the receiver. The back and forward motion of the pulsations reacts on the ratchet-type advance and in effect becomes the source of power for operating the index. The index mechanism thereby duplicates the exact reading of the index of the gas meter. The slow, synchronous pulsating action of the two diaphragms is an ideal means for the remote reading of gas meters.

Only three steps are required for installation. The first is the mounting of the transmitter element in the upper gallery chamber of the tin case gas meter; the second step consists of attaching the receiver unit on the outside; connecting the copper tubing between the units completes the installation.

Mounting of the transmitter can be accomplished either during meter service operations, or at the gas meter manufacturer's plant at the time of original assembly of the meter. Mounting this element requires the soldering of three points, two on the gallery deck and the third on the side of the meter. A small hole in the side of the meter is required for the copper tube connection to enable coupling the tube to the receiver.

Preliminary estimates of manufacturing costs for production runs of substantial size, including the transmitter and receiver units, indicate a tentative net price of $10.50. Installation cost figures based on single, inconclusive installations are estimated at $1.10 for material and 1 hr and 15 min. in total labor.

Sangamo Electric Co.



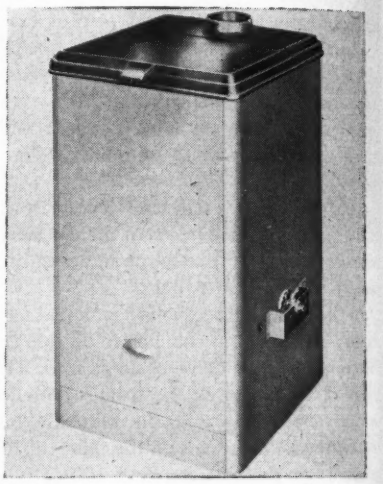
6 Combination Analyzer

Completely new, a combination Bailey oxygen and combustible analyzer is suitable especially where multi-fuels or fuels of varying composition are fired and where a safety guide is needed to prevent the lighting off of upsurged, gas-fired combustion chambers.

Analyzses of $\%O_2$ and % combustion are offered in a single, compact unit. The gas analyzer and its recorder indicate or automatically control the necessary adjustments required to maintain maximum combustion efficiency within combustion equipment limitations.

Bailey Meter Co.

■

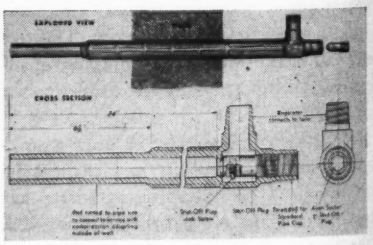


7 Gas Incinerator

The new Economy Burnall home garbage incinerator requires only 1½ sq ft of floor space. The Whale-Fluke burner spreads the gas beneath and through the grate, drying and consuming garbage and rubbish. The ash pan will hold a month's accumulation of the fine ash.

Comstock-Castle Stove Co.

■



8 Service Fitting

Designed to promote safety and economy in making services through walls, a new one-

piece wall service fitting is now in production by M. B. Skinner.

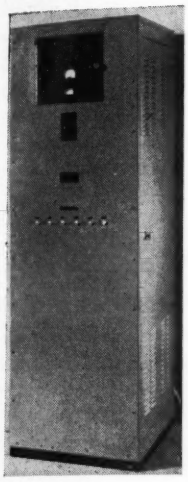
The device consists of an extra heavy, malleable iron tube with the end outside the wall turned to pipe size to connect to the service pipe with a compression coupling. The part that passes through the wall is heavily ribbed, serving to anchor the fitting when grout is tamped around it and into the hole in the wall, thus causing it to pull off at the compression coupling if there is accidental extreme strain on the service line.

The end inside the wall incorporates a branch tee and an angle valve of tamperproof design. The service fitting is available in ¾-, 1-, and 1¼-in. pipe sizes.

M. B. Skinner Co.

■

9 Combustible Gas Alarm

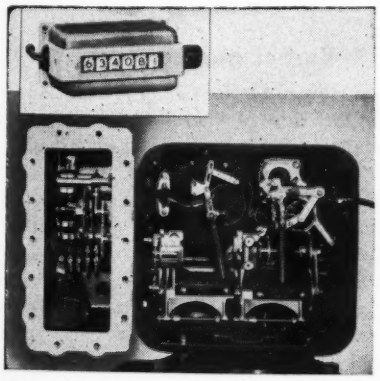


Sequential sampling of potentially explosive atmospheres from six separate locations is possible with the new Johnson-Williams Model RV-6 indicating type combustible gas alarm.

Model variations are available to permit sampling from any number of locations from two to eight. The detecting instrument is a platinum filament Wheatstone Bridge detecting circuit. Indication of the presence of combustible gas is provided on a panel-mounted indicating instrument, while the sample line current being analyzed is indicated by a series of pilot lights on the front panel of the free-standing steel cabinet in which the alarm is housed.

Johnson-Williams Ltd.

■



10 Base Volume Index

With American Meter Co.'s new base volume index Telecounters, any convenient location may be selected for remote reading of base volume index indications. Measurements registered on the base volume index, which automatically corrects the gas meas-

THERE IS A *Security* AUTOMATIC

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Security Valves will provide automatic shut-off in the event of either increase or decrease in pressure. Installation may be upstream or downstream (in relation to the regulator), with or without static line control, for either high or low pressure application.

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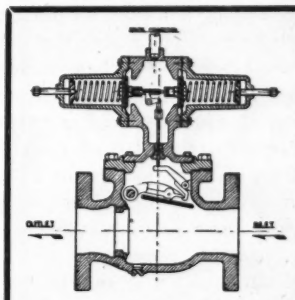

MODEL "IDPS-H"

(closes on Increase OR Decrease in Pressure; Static line control, High pressure application). Described in detail in Bulletin 227-C.

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ured by the meter to base temperature and base pressure conditions, are accurately transmitted from the meter site to a remote electrically operated counter at the reading point selected.

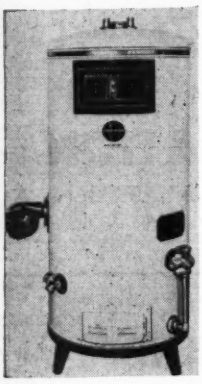
The transmitting device is mounted on the side of the base volume index in an explosion-proof housing. Its mechanism is actuated by the same motion that drives the mechanical counter of the base volume index.

Pure d.c. for the Telecounter circuits, from commercial powerline sources, is provided by a Power-Pack. Signals are transmitted by wire lines or by radio. Use of Telecounter equipment with transmission systems sending more than one measurement over a single circuit is possible if multi-channel radio links or carrier current equipment are used. Transmission of information on the system must be continuous from each measurement.

American Meter Co.

■

11 Combination Water Heater



A combination automatic gas water heater and space heater, designed specifically for milk houses, medium-size unheated kitchens, small offices, and damp basements, has been announced by John Wood Co.

The new Merion dual-action water heater, which operates on all types of gas, is said to be capable of raising room air temperature of a small room approximately 45° within one hour by using the heated air which normally surrounds the inner hot water storage tank. Room heating is achieved by an automatically controlled blower which circulates the air around the inner tank and expels it out into the room through a vent in front of the heater.

John Wood Co.

Trade Literature

12 Equipment Bulletin

Information on its complete line of meters, control equipment, and engineering services is contained in a new bulletin from Bailey Meter Co. Intended for engineers in public utilities, power plants, and process plants, the bulletin presents 14 measured variables common to power and process operations in the form of an index for selecting appropriate metering and control equipment. Basic specifications, illustrations, and detailed literature references are included.

Bailey Meter Co.

■

13 Clamp Folder

A folder explaining use and applications of a new dual-purpose coupling-repair clamp manufactured by Morris Coupling & Clamp Co. is now available. A 6-step method of assembly is outlined highlighting the simplicity, speed and durability of the clamp.

Morris Coupling & Clamp Co.

■

14 Tube Fitting Catalog

The Imperial Brass Manufacturing Co. has recently issued a 28-page catalog covering tube fittings and tubing tools for plumbing and heating, oil burner, L. P. gas and city gas applications. Included in the illustrated catalog is complete information on the Rol-Air flaring tool, which both flares and burnishes tubing, and description of Imperial's line of Kwik-Tite compression fittings and flared tube fittings.

Imperial Brass Manufacturing Co.

■

15 Tool Catalog

Pipeline tools produced by Beaver Pipe Tools Inc. are described and pictured in their condensed catalog and resale price sheet. This catalog carries information on pipe and bolt threaders, square end sawing vises, pipe reamers, power and hand cutters, and pipe and bolt machines. Also included is the new Beaver Model "D" power drive, Beaver No. 55 nipple chuck and the newest additions to the Beaver line, the No. 2 and No. 4 direct pressure pipe cutters.

Beaver Pipe Tools Inc.

■

16 Valve Brochure

Minneapolis-Honeywell's new dual-action Modusnap automatic gas valve is described in a brochure published by that company. Also available from the company are envelope stuffers titled "Homer the Helpless Heater," which graphically tell the homemaker how she can have automatic heat control by installing the Modusnap valve.

Minneapolis-Honeywell Regulator Co.

■

17 Excavator Specification Sheet

The recently introduced C-35 Crawler crane excavator from Schield Bantam has been described in a specification sheet that gives complete specifications and engineering data. Interchangeable attachments are illustrated as are the various parts of the crawler.

Schield Bantam Co.

■

18 Technical Bulletins

Technical data, description and illustration of equipment manufactured by Eclipse Fuel Engineering Co. are included in three new bulletins now available. (When ordering copies, use letter preceding description together with number of the notice.)

(a) Bulletin C-2 tells of the gas-fired crucible furnaces manufactured by Eclipse for melting non-ferrous metals.

(b) Bulletin H-9 describes Eclipse injector-type box burners for conversions or original equipment applications.

(c) Bulletin R-230 gives data concerning the Eclipse series "CF" closed flame gas-oil burners.

Eclipse Fuel Engineering Co.

■

19 Burner Manual

"How to Service Center Simmer Burners" is the title of the first complete service manual ever produced on the subject of maintaining and servicing its burners by Harper-Wyman Co. The new 48-page pocket-size manual has been designed to give the gas range dealer and his servicemen information that will enable them to give superior maintenance and installation service.

In addition to covering such subjects as burner types, types of valves, automatic light adjustment, etc., the back of the book contains an appendix of reference charts with information on orifice capacities at various pressures for various types of gases and burners, orifice areas and diameters, plus volume and pressure equivalents.

Harper-Wyman Co.

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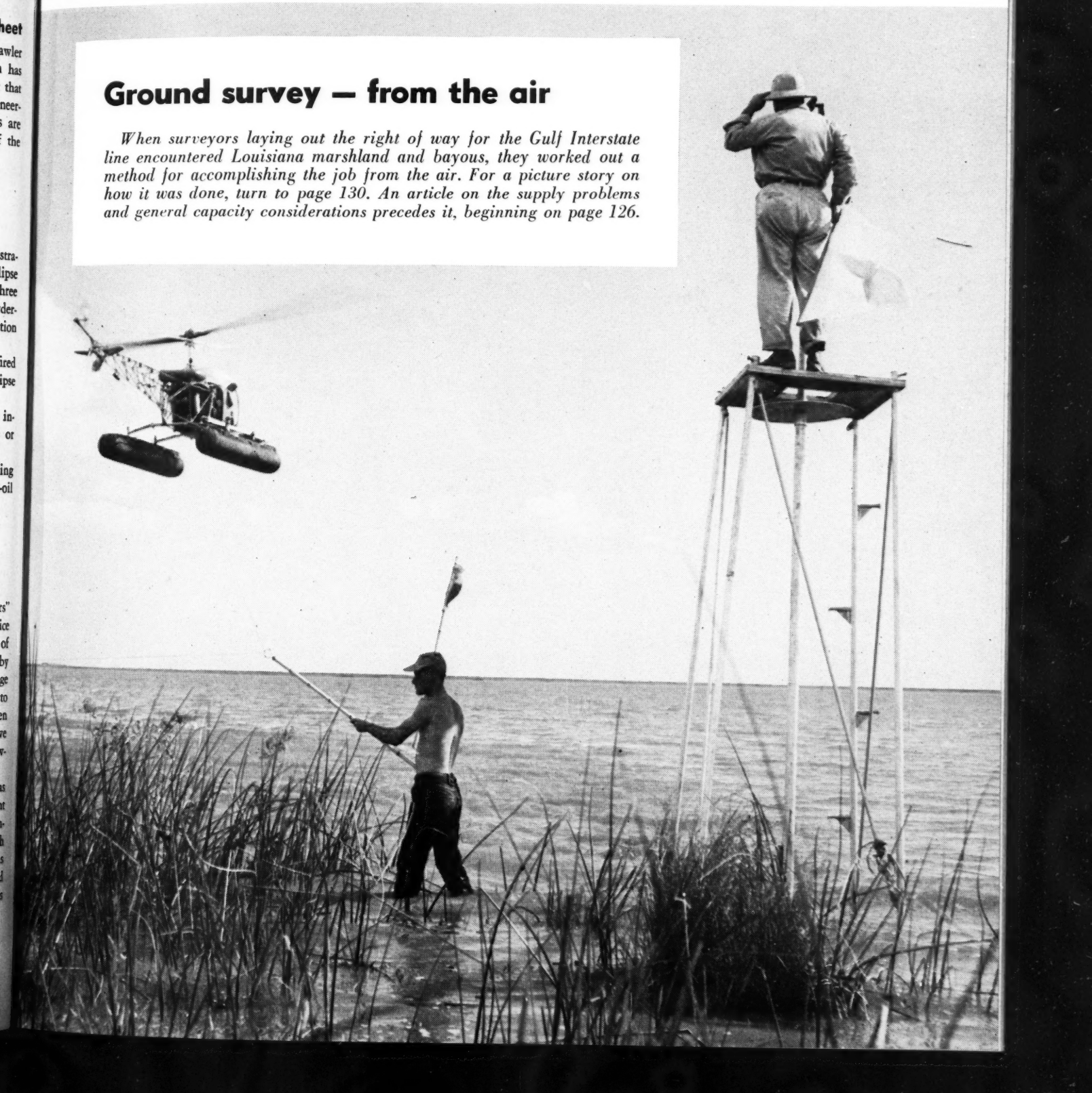
Transmission and Conditioning Section

Ground survey — from the air

When surveyors laying out the right of way for the Gulf Interstate line encountered Louisiana marshland and bayous, they worked out a method for accomplishing the job from the air. For a picture story on how it was done, turn to page 130. An article on the supply problems and general capacity considerations precedes it, beginning on page 126.



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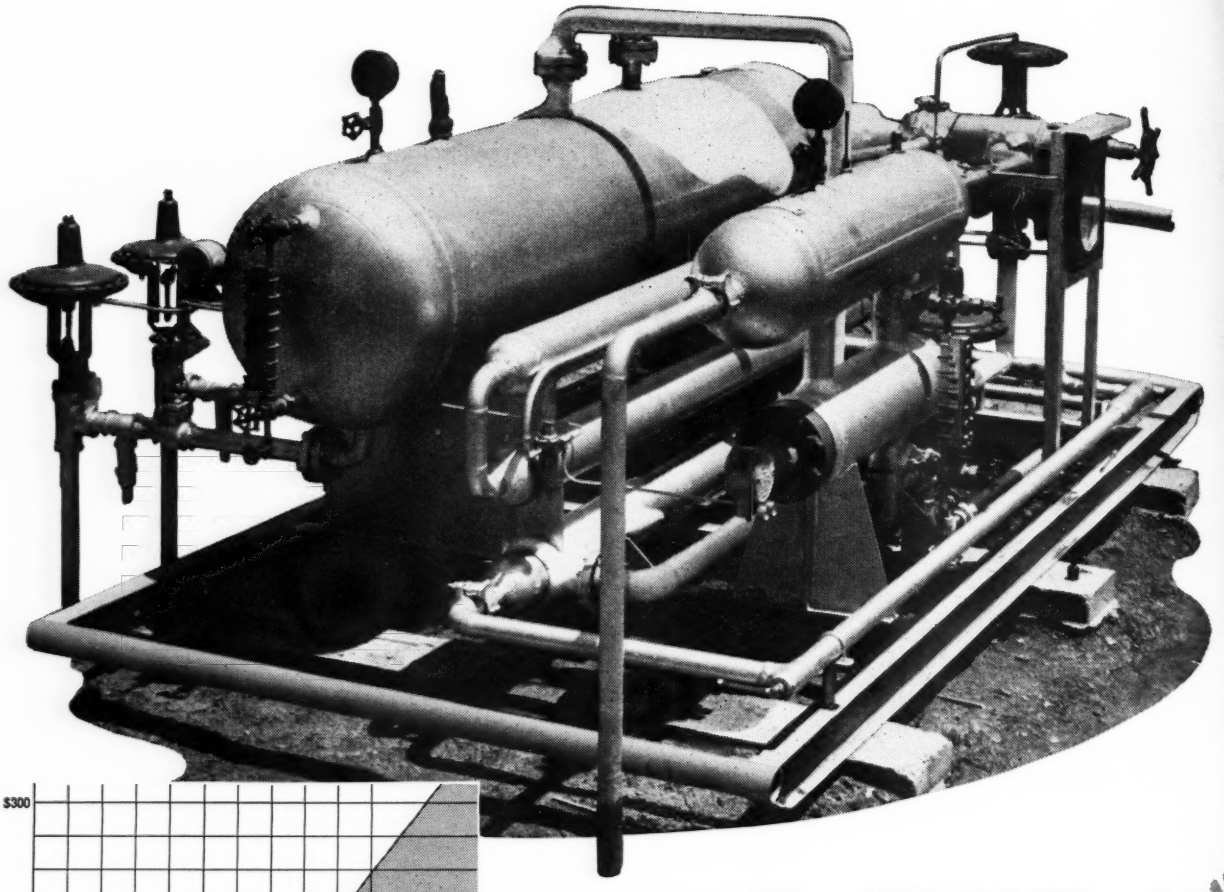

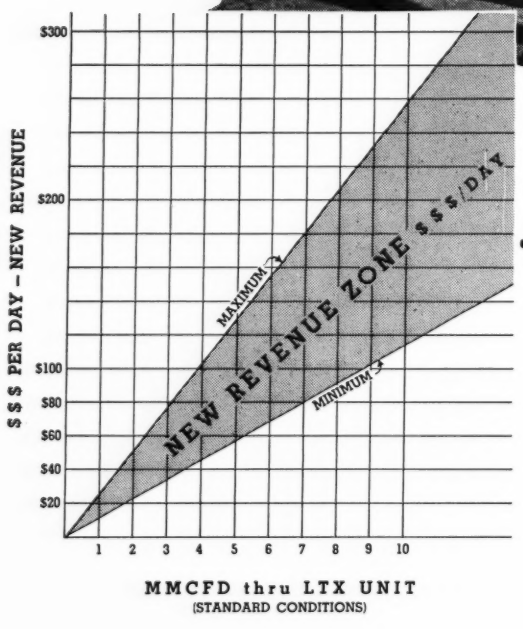

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This is the first of two 10 MMCF, 1000 psi National LTX Units set on a lease in East Texas. Production figures reveal that the well made 9 bbls. of distillate per MMCF on potential test through standard separation. After setting the National LTX, production increased to 15 bbls./MMCF. The operator flows 4 MMCF/day. This means an increase in distillate recovery of 24 bbls./day valued at approximately $66.00 or $24,090.00 per year.

* T.M. Reg. U.S. Pat. Off.

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NATIONAL TANK COMPANY

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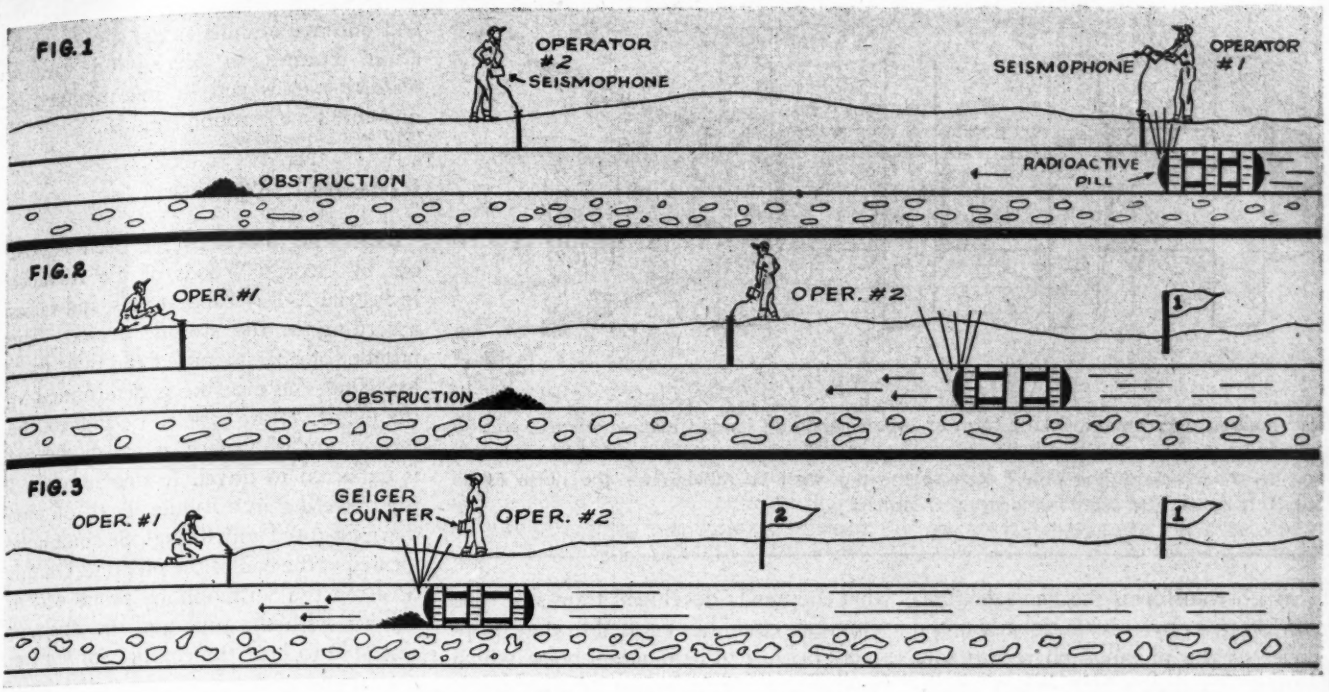


Leapfrogging Seismophone operators trail the pipeline pig and use flags to chart its progress through a line. If the pig should become stalled by an obstruction a Geiger counter operating on radioactive radiation is called into play to pinpoint its location.

How to chase a pig through a pipe

By **FRANK CHAPMAN** • Feature Editor

• *Pipeline pig chasing has been systematized by use of a newly developed sonic listening device, which logs the progress of the pig as it travels through the line, and a Geiger counter operating on radioactive radiation to go after a stalled pig.*

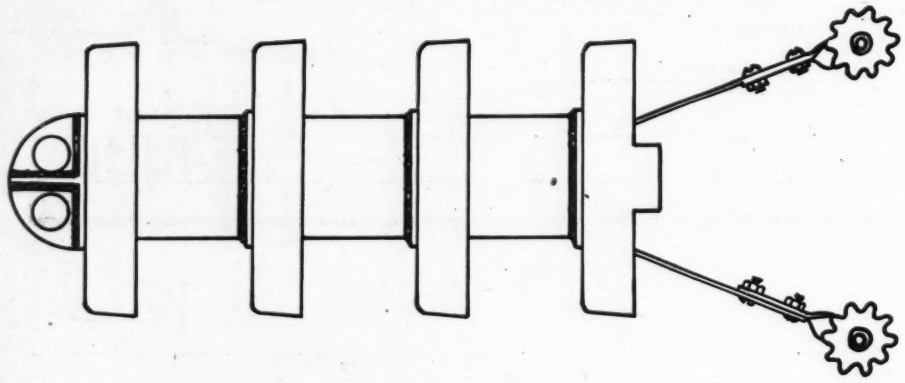
AN ultra-sensitive electronic stethoscope that can pick up sounds made by a pig as it scrapes its way through a pipeline as far away as four miles has been added to the pig locator's bag of tools. The device, known as a Seismophone because of its similarity to a seismic shock detector, consists of a pointed metal probe, a high gain amplifier, and a pair of ordinary headphones. Seismophone operators "listen in" on noises made by the pig and systematically chart its progress through the pipeline so that if the pig should become stalled, its position can be localized in a comparatively short section of pipe. This facilitates the use of a Geiger counter or the Seismophone itself, if the pig has a noise-making attachment, in pinpointing its exact location.

The Seismophone was developed by Dr. Gordon L. Locher of the Advance Industrial X-Ray Laboratories of Los Angeles. Dr. Locher is a radiation physicist who has done a great deal of work with the Geiger counter as a device for locating lost pigs. The precautionary measures necessary in handling radioactive materials and the difficulty often experienced in detecting radiation from a radioactive-laden pig deep in the ground, even with the most sensitive Geiger counters, have led him to search for a more practical means of pig locating. The Seismophone is the outgrowth of this search.

The sensing element of the Seismophone is a barium titanate crystal that is located in the pointed end of the hollow steel probe. A small tungsten weight fixed to the crystal element transmits mechanical sound vibrations to it as a bending action, which causes the crystal to generate minute electrical impulses. In this respect, the sensing element operates like an ordinary phonograph pick-

Dr. Gordon L. Locher and the Seismophone he developed for chasing pipeline pigs. The probe which contains the sensing element and first stage amplifier is inserted into the ground at left. It is connected to the high gain Seismophone amplifier contained in the box on the ground.

GAS exclusive



Noise-making attachment, in the form of a pair of spring loaded ratchet wheels, can be attached to the rear of the pipeline pig. The ratchet wheels make a noise as they ride along on the inside of the pipe. Because the pig must be moving for the noise to be created, it cannot be used for locating a stalled pig.

up, which transforms mechanical vibrations created by undulations in the grooves of the phonograph record into electrical impulses which, when amplified, are played back as audible sound. A sub-miniature, hearing aid-type tube, also located in the hollow probe, is used to amplify the weak signals developed by the crystal element. A cable connects the output of this amplifier tube from the end of the probe to an additional amplifier section carried by the Seismophone operator.

Four-foot probe

The probe may be of any length depending upon the requirements of the project. However, in most instances a 4-ft long probe has been found satisfactory. Best results are obtained with the probe in actual contact with the pipe although suitable pickup is realized with the probe driven into the ground above or to one side of the pipe as near to it as possible.

A high-gain, four-stage amplifier of conventional design and a power supply unit are contained in a metal case which is carried by the operator. Because of the extreme sensitivity of the equipment, special design considerations were necessary to keep the background noise level below a point where it would tend to interfere with the low level sounds picked up by the sensing unit. A specially designed rustle-free cable was required between the probe and the amplifier unit to minimize the pickup of physical disturbances such as the sound of the wind, which would tend to raise the background noise level. Extreme care was also taken in the design of the amplifier to eliminate any noise-generating circuits or components. It is of interest to note that the newly developed transistor type amplifier could not be used in the equipment because of its inherent noise, which is considerably in excess of that developed by an ordinary triode-connected miniature pentode amplifier tube.

Isolating noise component

In the design of the Seismophone Dr. Locher has taken into consideration the frequency characteristics of various sounds along with the frequency sensitivity of the human ear. His analysis has indicated that an amplifier which favors the higher frequencies will help the operator to more readily distinguish the sounds created by a moving pig or by escaping gas and water from those created by the ordinary rumble of wind, traffic, and other disturbing factors. The fairly low frequency sound generated by the dull thud of a compressor can in this fashion be isolated from the higher frequency components of noise developed by a scraping pig.

Although it is not possible to eliminate all unwanted noise and at the same time retain the wanted sounds, it is possible to peak tune the amplifier section to a certain portion of the audible spectrum so that sounds in one specific range will be more readily distinguishable than those in another range. Based on this theory, two frequency response ranges are included in the Seismophone. As an untuned amplifier the resistance-capacity coupled circuits favor the higher frequencies. A front panel switch, however, will convert the circuits to semi-tuned inductance-capacity sections which have a maximum response in the vicinity of 1000 cycles per second.

Experience has shown that trained operators can make use of both tuned and untuned circuits as the specific situation requires in identifying various wanted sounds and in minimizing the unwanted background sounds.

Operating procedure

Operating procedure has been worked out by George Woods of the Advance Industrial X-Ray Laboratories, and varies according to the specific project. The number of operators used and their spacing along the pipeline is determined by the length of the pipe to be pigged, the terrain, and the speed at which the pig is expected to travel. In one instance a pig traveling in a 4-mile lengh of pipe was monitored with a single Seismophone located at the end of the pipeline. On this occasion the Seismophone probe was in contact with the pipe and the operator was able to hear the compressor start at the far end of the pipe—four miles away—before the pig got under way.

Generally Mr. Woods uses more than one operator on a pig-chasing project. Operators are usually spaced along the pipeline at electrolysis stations or at similar locations where it is convenient for them to work. When the pig gets under way the first operator, located nearest to the upstream end of the pig run, is alerted and follows its progress by sound. When he hears the pig pass his position he places a flag in the ground as an indication to the next operator down the line. In this way the progress of the pig is followed through the entire length of the pipe or until it has become stalled.

Leap-frogging

If the speed of the pig is relatively slow, two operators may be used in leap frog fashion. After indicating that the pig has passed his position, the first operator will jump the next position, where a second operator is located, and take up position down the line. Operator number two will do likewise, skipping every other position, until the pig has completed its trip. Radio communication is often required between stations to coordinate the activities of the Seismophone operators. Jeeps and motorcycles are also used to transport operators from station to station.

If a pig should become stalled, its position can immediately be narrowed down to a point between the last flagged station and the next operator. Often an operator can, by experience, indicate almost exactly the position where the pig

has become stalled. However, generally speaking, the Geiger counter is relied upon to pinpoint the location of the pig. With the location of the stalled pig known within fairly close limits, the job of determining its exact position with a Geiger counter is considerably simplified.

Stalled pig can be heard

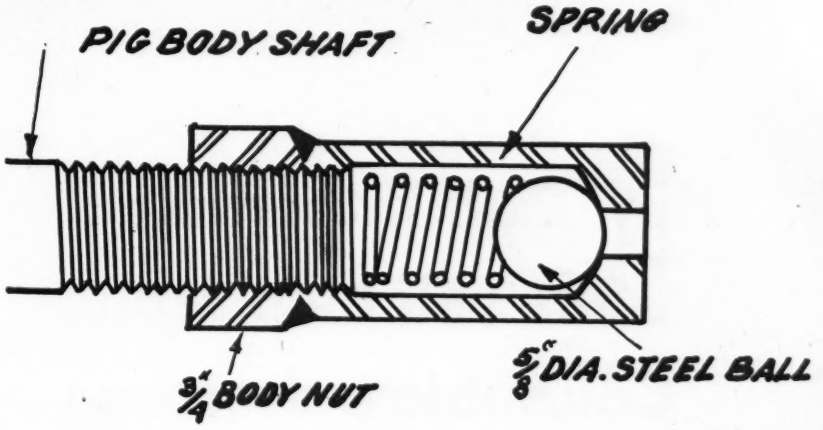
However, just because the pig has stalled is no indication that it is no longer a noise-maker and cannot be picked up by the Seismophone operator. The sensitivity of the Seismophone is so great that it can often be used to locate a stalled pig by picking up the sound of escaping water or gas as the pig creates a partial obstruction of the pipeline. When the Seismophone operator hears the pig stall he continues to listen for other sounds which might indicate that it is trying to break loose or that it has broken loose from whatever is holding it, or that it has become damaged and is partially blocking the pipe. In fact, the operator must take extreme care once the pig has become stalled for, with pressure building up behind it, if it does break loose it will travel at a much higher rate of speed than expected.

Parenthetically, the application of the Seismophone in locating a stalled pig by listening to the sound created as it partially blocks a pipeline suggests the use of the device as a gas leak detector. The equipment has been used to indicate the presence and approximate location of a small gas leak in a fairly confined area. However, potentialities in this direction must await further investigation.

Noisemaker helps

A noise-making device attached to a pipeline pig can, of course, be used to advantage with the Seismophone. Attachments of this kind are made by T. D. Williamson Inc. for its line of pigs. One type made by the Williamson company consists of a pair of spring-loaded ratchet wheels which are fastened to the rear of the pig and contact the pipeline wall. As the pig travels through the line the ratchet wheels ride along on the inside of the pipe wall and create an audible sound. Noise-makers of this kind are most valuable with displacement type pigs which are ordinarily quiet in operation.

Williamson also makes a sonic oscillator, bypass type noise-maker that will operate with a stalled pig. The device consists of a small cartridge-like metal tube that is threaded on to the end of a hollow pig body shaft. A small hole in the end of the cartridge is held closed with an internal, spring-loaded steel ball. When the pig stalls pressure builds up behind it which causes the ball to depress the spring and allow a release of water or gas through the hollow pig shaft. With the release of pressure the ball again closes the opening in the cartridge. The rapid repetition of this process causes a rattling sound which can be heard for some distance.



A sonic oscillator type noise-maker can be attached to a pipeline pig to generate a noise when the pig becomes stalled. When pressure builds up behind a stalled pig the spring-loaded ball is caused to oscillate as pressure is released through the hollow pig body shaft.

Electronic devices

Various methods have been considered from time to time for electronically generating a sound or signal by which a pig may be traced. Obviously, the emission of a radio signal is not satisfactory because of the shielding effect of the pipe, and equipment that makes use of an electromagnetic field is equally unsatisfactory for the same reason. In any case a problem of power supply for an electronic device, as well as the problem imposed by the possibility of the equipment becoming inoperative if the pig itself is damaged, must be taken into consideration.

However, as a companion piece to the Seismophone, Dr. Löcher has proposed the use of an audio oscillator and transducer as a signal generating and transmitting device. The oscillator would be enclosed in an air-tight container and attached to or dragged behind the scraper. It would generate a 1000-cycle signal which would be modulated to create a warble that would be readily distinguishable. The unit would have a self-contained battery power supply of sufficient capacity to run for the duration of the expected pig travel plus a reasonable margin in case the pig should become stalled. Power requirements, however, would not be great because a few watts of sonic energy should be sufficient for tracking down the pig in most situations.

Transducer

The heart of the device is a transducer that acts like a large loudspeaker driving unit. A piezoelectric ceramic underwater transducer in the form of a hollow cylinder would be used to transmit the 1000-cycle vibrations to the pipeline. The transducer is most efficient when operated in water rather than gas, and for this reason it would, if possible, be located in front or behind the pig depending upon the presence of water. The 1000-cycle vibrations are transmitted through the water to the pipe and along the pipeline in both directions. A Seismophone located along the pipeline in either direction would pick up the signal and, on the basis of its intensity, indicate to the operator the approximate location of the pig. Such a device would be equally effective whether the pig is traveling or stalled.

With a device on the pig which will generate a substantial amount of noise, either electronic or mechanical, there is less need for exceptionally high gain in the sensing equipment. In such a case junction-type transistor amplifiers might be used. The obvious advantages of transistor amplifiers are their small size and low power requirements. Additionally, junction-type transistors are reputed to be very quiet in operation—an important consideration in the design of sensing equipment.

How Gulf Interstate line will help reduce Columbia's shortage

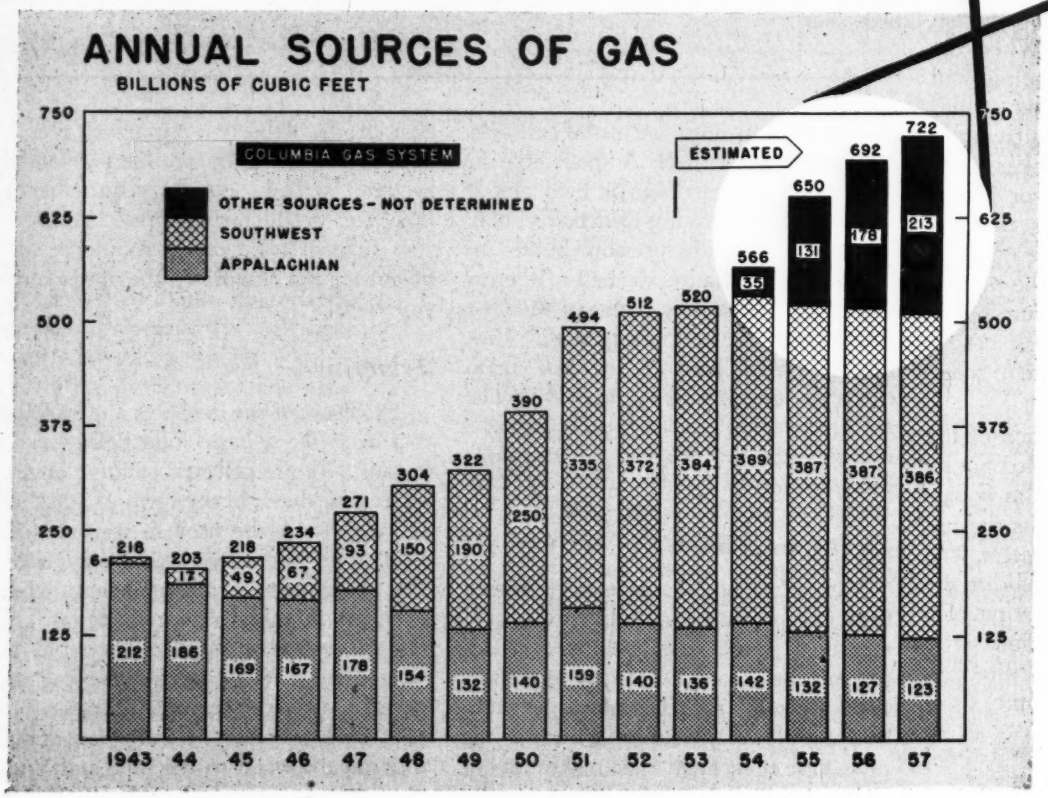


Fig. 1. Completion of the Gulf Interstate Gas Co. line will materially reduce the portions of Columbia Gas System's needs that will have to be met from "Other Sources — Not Determined" (see inset). Nevertheless, Columbia must still uncover new sources to supply additional needs for the next four years ranging from 18 billion in 1954 to 103 billion in 1957. Chart shows amazing growth in system in past decade.

By **GEORGE S. YOUNG** • Columbia Gas System Inc., New York

BACK in 1940 the Columbia companies sold 146 billion cu ft of gas. Annual sales reached 195 billion in 1946, the first full year after World War II. But since 1946 the rate of growth in sales has accelerated until, in 1952, they reached 430 billion cu ft. That's a tripling of sales in 10 years—this in spite of some limitations which we have had to impose.

Now where did the Columbia companies get the gas to make these ever-growing sales in the past decade? And where will it come from in the future?

Until 1943, it came from wells in the Appalachian area, some of which were owned by the Columbia companies and some owned by independent producers. In 1943, the system got its first substantial supply of gas from the Southwest, but initially it amounted to only 3% of the total. But by 1952, 73% of the system's gas had its source in the Southwest.

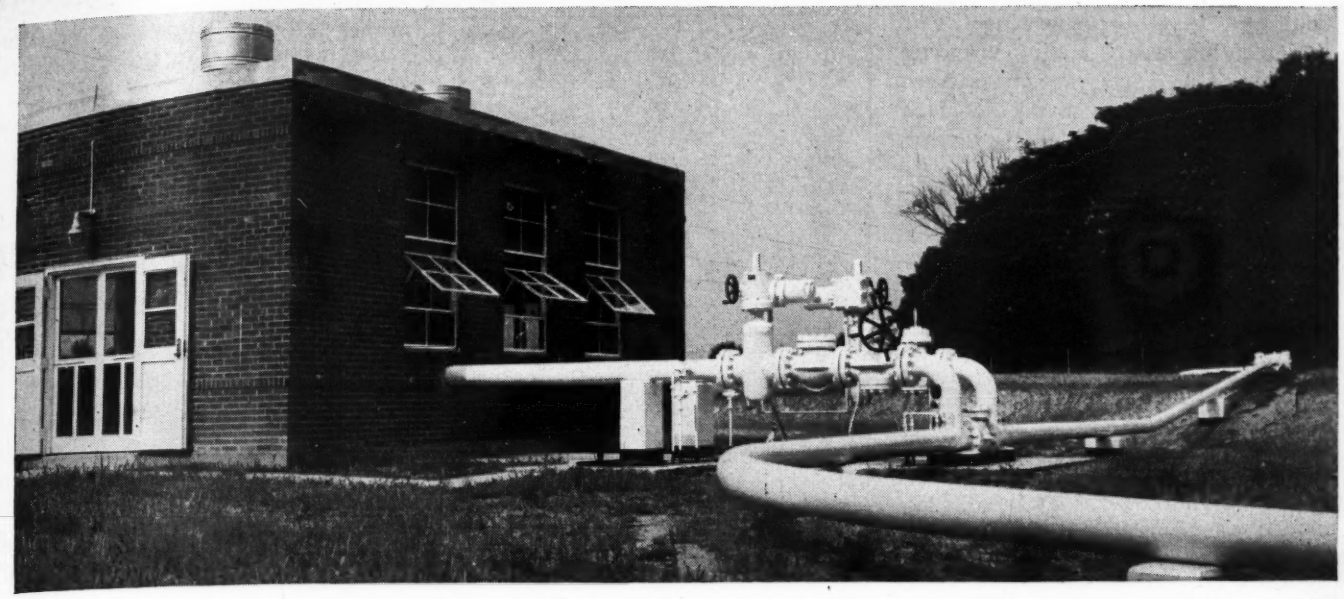
These supplies of Southwest gas were not acquired easily. Most of our pipeline suppliers have enjoyed a sellers' market from the time they started to deliver gas. We had to compete with other utilities for our share of it.

The process of estimating and re-estimating the system's gas requirements and gas available goes on—almost continuously, I should say—for periods five years in advance.

So let's take a look at what those estimates indicated several years ago for the winter of 1954-55 *(Fig 1)*.

The item, "Other Sources—Not Determined," had been recurring in estimates for a number of years. We were successful in obtaining large supplies of

This article has been excerpted from a talk presented by Mr. Young at the Appalachian gas measurement short course at West Virginia university in August.



This Illinois pumping station is controlled by a man in Radio City

When dialed, the pumping station automatically sends its meter readings via teletypewriter to dispatcher in New York.

Shell Oil Company's automatic pipeline pumping station in Dennison, Ill., is supervised and controlled over Bell System lines from an ordinary telephone dial in New York City—more than 800 miles distant!

For meter readings, Shell's dispatcher in New York's Radio City dials a number. Back on the teletypewriter from the Dennison station come suction and discharge pressures and motor current readings.

He dials other numbers to start or stop the pump, open or close valves or to summon an attendant.

This remote-control system keeps the pipeline—which carries 22 different finished petroleum products—operating smoothly from one central location. Dennison is only one of four similarly controlled pumping stations on the line.

Using Bell System communications, you get the benefit of new developments without tieing up capital.

Whether you need private-line telephone, mobile telephone, or teletypewriter service, or channels for remote metering and supervisory control, you'll find research and experience of the Bell System give you the best services available.

Your Bell Telephone Company will be glad to study your communications problems and needs without charge.

PRIVATE-LINE TELEPHONE

TELETYPEWRITER

MOBILE TELEPHONE

METERING CHANNELS

BELL TELEPHONE SYSTEM

Southwest gas—now approximately 1 billion cu ft per day—and in expanding our facilities to deliver it to our markets. But when we tried to obtain the added supplies to meet these large estimated requirements we weren't able to get them from our present pipeline suppliers, largely because of their reluctance to risk additional capital to build new capacity at this time. And since pipeline companies are under no legal obligation to construct additional facilities, they can stop building if they choose to do so. We can't.

So in 1951 we were faced with an estimated demand in 1954 and 1955 far greater than our visible gas supply.

Supplies for the future

What had to be done then was to find greater supplies of gas for the future—and a means of bringing it into the system. The logical place to look was in the Southwest—and the logical source was the oil companies who were finding gas in connection with their oil explorations.

About two years ago, Irving K. Peck, vice president of our service company, was placed in charge of gas procurement. At about the same time we were conducting conversations with people who might be willing to build a pipeline—if we got the gas. In short, here is what ensued:

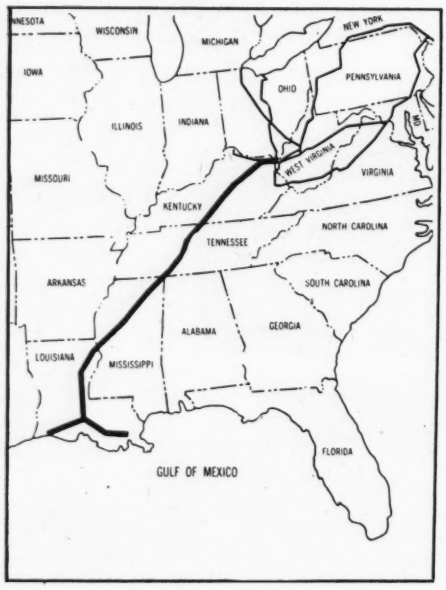
On Feb. 21, 1952, Gulf Interstate Gas Co., a non-affiliated company, was incorporated.

By September 1952, Mr. Peck had succeeded in negotiating contracts on behalf of United Fuel Gas Co., a Columbia subsidiary, for a gas supply totaling over 2 trillion cu ft, a quantity sufficient to insure a delivery of 300 million cu ft per day for approximately 20 years and enough to support construction of the proposed 30-in. Gulf Interstate pipeline.

Contracts signed

Those initial negotiations involved the signing of 21 separate contracts with 14 major producing companies and dozens of minority owners. The contracts are for gas in 16 different fields located in south Louisiana. Since then more contracts for more gas have been negotiated.

Aside from the purely technical complications involved in negotiations of that size and scope, Mr. Peck faced the added handicap of being a buyer in a sellers' market. We particularly wanted that Louisiana gas because, as Southwest gas goes, it is closest to our markets; because geological studies indicate abundant reserves there; and because certain contracts could be negotiated with a flexibility as to supply which is well suited to our needs.



Route of new Gulf Interstate natural gas pipeline, showing feeder lines and market area to be served.

Producers join in

The first break came shortly after the incorporation of Gulf Interstate. Seeing in the new pipeline an outlet for gas in volume, one of the major producers in the South Pecan Lake field agreed to deliver nearly a half trillion cu ft over a 20-year period. Contracts followed in other fields. In the meantime, negotiations were begun for purchases from the Erath field, the largest in southern Louisiana. Erath has recoverable reserves estimated to be well over a trillion cu ft. It is controlled by four oil companies—the Texas Co., Phillips Petroleum Co., Humble Oil and Tidewater Associates.

It was not until September 1952 that contracts with those owners were negotiated for the purchase of some 730 billion cu ft from Erath, an average of 100 MMcf per day for 20 years. With that transaction completed, it was felt that the reserves then under contract were sufficient to warrant an application to the FPC for a certificate of public convenience and necessity. Gulf Interstate filed its application on Sept. 12, 1952. On May 20, 1953, the Federal Power Commission, issued a certificate granting permission for the line to be built.

Several conditions were attached to the commission's order. These conditions have been met, the money has been raised, and the Gulf Interstate people are now building the line.

Gulf Interstate is being built by the same people who built, own and operate Trunkline Gas Co.'s line, and we have every confidence that Gulf Interstate, which incorporates most modern design, will be operated as efficiently as Trunkline. As pipelines go, Gulf Interstate will be unique in at least one respect. One system, Columbia Gas System, has arranged to receive all the gas which Gulf Interstate, an independent pipeline, transports. Gulf Interstate will not own the gas it carries, as is customary with other pipelines. It will gather gas, which Columbia owns, in the various fields, and deliver it to the United Fuel Gas Co.'s lines. Gulf Interstate is a separate organization, independent of and not affiliated with Columbia.

860-mile line

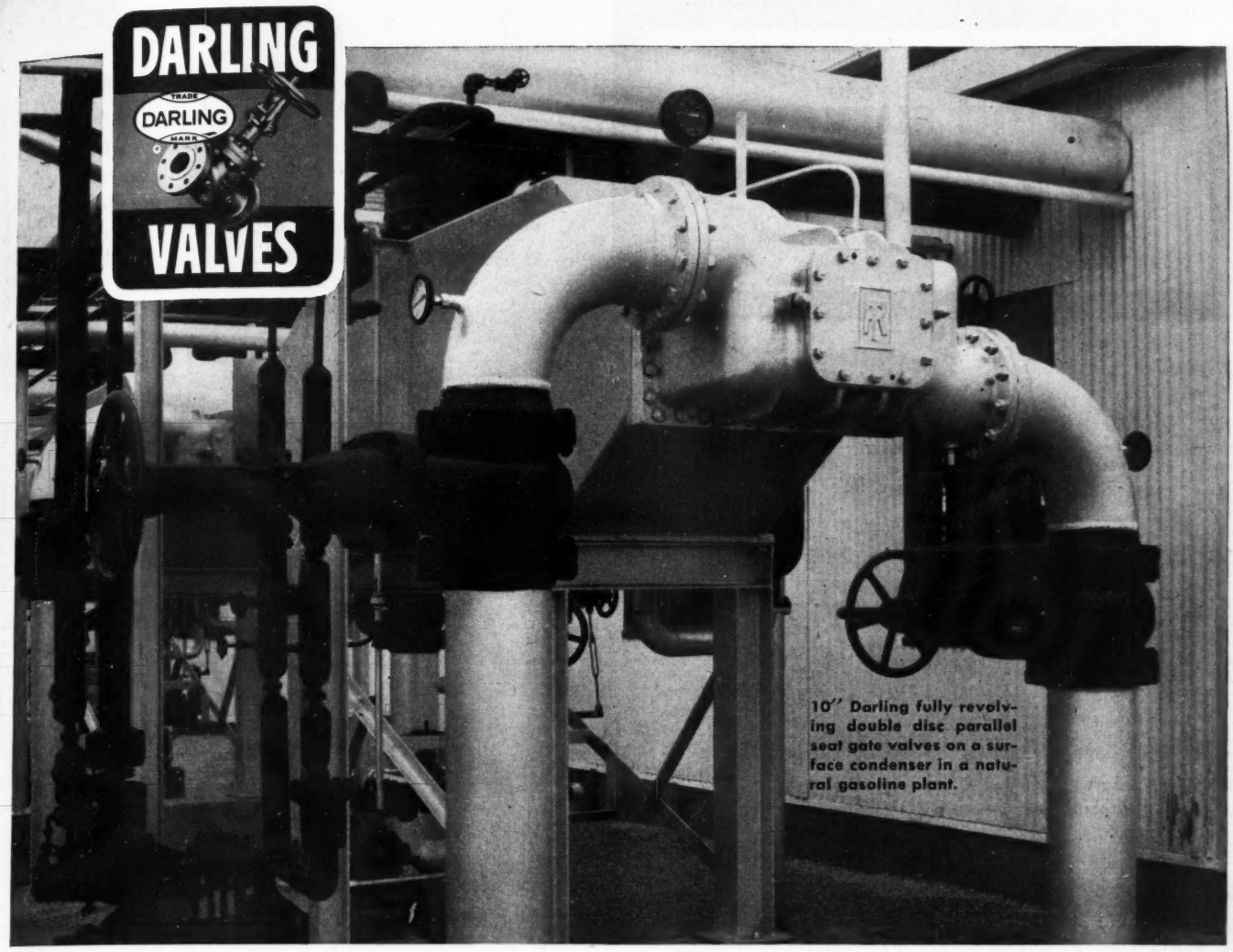
The line being built is shown on the map, beginning with the two feeder laterals. These laterals will total 319 miles in length and vary in size from 12 to 24 in. The main 30-in. line begins near the little town of Rayne in Acadia parish. From there it will extend northeastward for 860 miles, through Mississippi, Tennessee, and Kentucky, under six large rivers, and will terminate at United Fuel's Kenova compressor station near the Kentucky-West Virginia line.

By the end of 1954, when construction is scheduled to be completed, it will be delivering 300-375 MMcf a day to the United Fuel Gas Co. The gas will be taken into the system's pooled supply and will increase the volume available for distribution to consumers in our seven-state territory.

Five compressor stations

The Gulf Interstate line will be powered initially by five compressor stations totaling 40,000 hp and will have an initial design capacity of 375 MMcf a day. The project will cost approximately $129 million when completed.

What it will mean, supply-wise, is graphically shown in the *Fig. 1* inset. Presently envisioned supplies and capacities will materially reduce the size of the "Other Sources—Not Determined" sectors in the next four years. Yet there still remains a demand that must be met from these undetermined sources. We must continue to locate them and bend our efforts to obtaining gas from them.



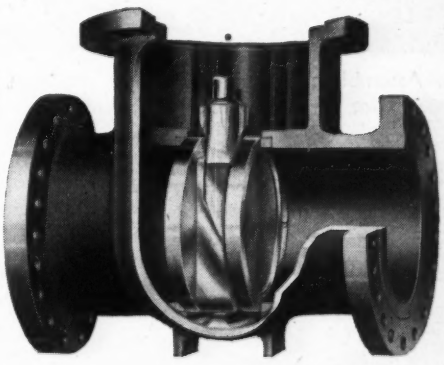
10" Darling fully revolving double disc parallel seat gate valves on a surface condenser in a natural gasoline plant.

How they save dollars in natural gasoline service with DARLING Revolving Disc GATE VALVES

TIGHT CLOSURE EVERY TIME!...That's one big advantage of Darling revolving disc gate valves on this surface condenser. The fully revolving double disc parallel seat feature of these Darling valves automatically compensates for valve body distortion, *assuring tight closure* and *uniform* distribution of disc and seat wear too . . . even under severe pressure and temperature changes.

JUST FOUR SIMPLE WORKING PARTS. . . . Two interchangeable, no-pocket discs and two husky wedges are all the operating parts in Darling *fully revolving double disc* parallel seat gate valves. No links or other devices are needed to hold the discs and wedges together. Any part can be quickly and inexpensively replaced without removing the valve from the line.

WIDE RANGE OF SIZES. Darling revolving disc parallel seat gate valves come in types and sizes for main line, gathering, manifold, tank farm and other gas and oil line services. Just outline your specific service requirements or write for descriptive literature today!



Cutaway showing complete simplicity of the Darling fully revolving double disc parallel seat principle.

DARLING VALVE & MANUFACTURING CO.

Williamsport 26, Pa.

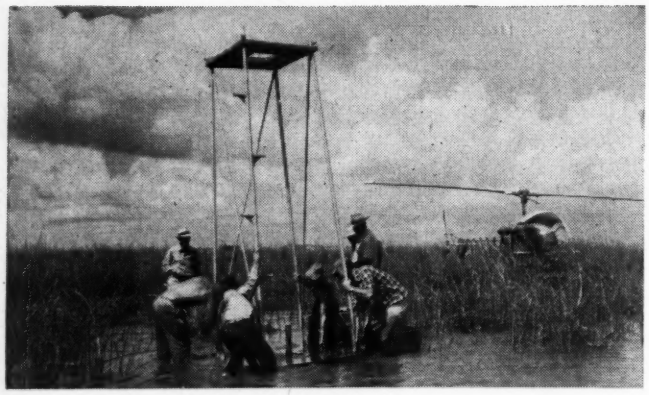
Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario

Ground survey — from the air

Gulf Interstate Gas Co. is building an 860-mile gas artery with 319 miles of feeder laterals (see pages 126-128), much of which traverses Louisiana marshland. Route survey crews have taken to the air to expedite the job, and with the help of a helicopter have been able to cover from 10 to 15 miles per day.

1. Helicopter prepares to land. Airborne crew will be joined at site by other party members who have been transported by boat.

2. Survey party checks location of first instrument point where the transit will be set up.



3. Assembling of the instrument platform begins. Note the small boat behind the men at the right.

4. With the platform in place, crewmen sink the pole on which the instrument will be mounted.

5. With instrument in place, helicopter begins to drag chain out, guided by signals from the man at the transit. One end of the chain, which is actually an aircraft wire cable, is attached to the 'copter and paid out by the man in front of the platform. When the aircraft is over the point to be marked, it drops down and sinks one of the flags into the water. Then it flies back, picks up the platform, instrument, and transit-man, and moves them to the spot marked by the flag, where the process is repeated. The platform can be carried intact and the instrument pole sunk through it from the air.

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CRANE CARRIER

For use with the Model T-35 BANTAM... the latest development in shovel-cranes.

LIFTS 12,000 LBS.!

LOW PRICED ONLY

$12,750

Complete, as Illustrated F.O.B. Factory

Lower price if Crane Carrier Extras such as double out-riggers and fenders not desired. (Price subject to change)

This brand new Crane Carrier, exclusively engineered for BANTAM mounting by a leading and famous truck manufacturer, answers the demand for all-new truck crane equipment with high-speed mobility. It's built right — and priced right!

This, too, is ALL NEW!

The Great C-35

CRAWLER

5-ton . . . ⅜ cu. yd.

Yours for only

$10,330

Complete Crawler Back Hoe with 30" bucket, f.o.b. Factory. (Price Subject to Change)

Now . . . BANTAM Offers Any Type of Mounting You Want

The versatile, job-proved BANTAM which has established enviable records of economy on all kinds of lifting and excavating jobs everywhere is now available with a wide choice of mountings, letting you select the best suited combination to handle your jobs faster and at far less cost.

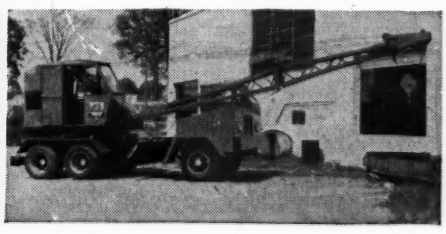
Today, you can get a BANTAM with a brand new, all-new Crane Carrier as illustrated . . . or mounted on a factory guaranteed re-built truck. Or, to save yourself more money, a BANTAM can be field-mounted on YOUR TRUCK.

But, that's not all! Then, to meet your needs for a top quality, low-priced ⅜-yard crawler shovel-crane, Schield BANTAM now offers the new Model C-35 . . . it's the revolutionary crawler everyone's talking about! And, best of all — no matter which type of mounting your work calls for, the complete BANTAM with any one of 9 fast-change front-end attachments is still the lowest priced, ⅜-yard, 6-ton shovel-crane on the market.

Investigate the BANTAM method . . . find out how a BANTAM lets you bid lower and get more work. Ask for a free demonstration on your job. See your nearest Schield BANTAM Distributor or contact the factory, TODAY!

SCHIELD BANTAM CO.
268 Park St., Waverly, Iowa

T-35 with Crane Carrier for fast job-to-job moves



T-35 BANTAM mounts on factory re-built 6 x 6 or on Your Truck.

ANOTHER NEW PRODUCT OF THE SCHIELD Bantam Co.

WORLD'S LARGEST PRODUCERS OF TRUCK-CRANES AND EXCAVATORS

Complete weld check setup prevents leaks on Indiana line

- *Welding school, on-the-job training also aid Northern Indiana in laying gas-tight lines through heavily populated areas.*

By **A. R. LINDGREN** • Magnaflux Corp., Chicago

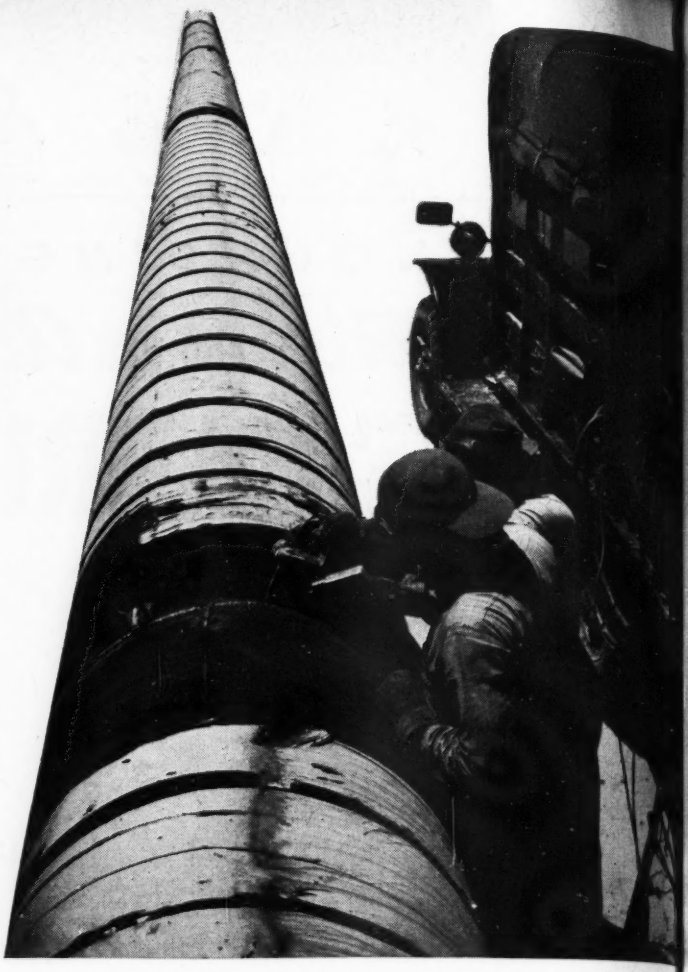


Fig. 1. Inspecting welds before lowering in pipe.

WHEN, during the past year, Northern Indiana Public Service Co. completed the laying of two major gas transmission pipelines, their leak-tight integrity was insured by a two-part program: careful training of the company's own welding specialists, and complete inspection of all welds.

No evidences of leakage have been found in either line, a 22-in. tube running 51 miles from Burns Ditch, east of Gary, to the city of South Bend, and a 36-in. pipe extending from the Illinois state line to Gary, 15 miles away.

NIPSCO did its own construction work on both lines, which are parts of a large expansion program begun in 1950. All told, 72 miles of high pressure lines and 84 miles of distribution mains are to be laid.

Extra care was needed in constructing the lines because of the concentrated populations and heavy industries in Northern Indiana's service area. A large number of industrial customers are localized around the Hammond, East Chicago, and Gary districts.

Uninterrupted service is an absolute necessity. Down time of plants means dissatisfied customers because of idle production workers and reduction in product output. In some cases, it means damage to costly equipment. In its new expansion program, therefore, Northern Indiana realized that sound welds and leak-free lines must be among the major considerations. Repair of operating leaks, even if minor, may mean interrupted service and costly excavation. Even those leaks detected during construction by preliminary pressure tests are expensive to repair, as in most cases back-filling has already been completed.

Personalized training

Since "on-the-line" welding accounts for the majority of leaks ordinarily found during the final pressure tests, Northern instituted a program of personalized welder training, which, according to Oscar Ruzek, manager of construction for the utility, has been highly successful.

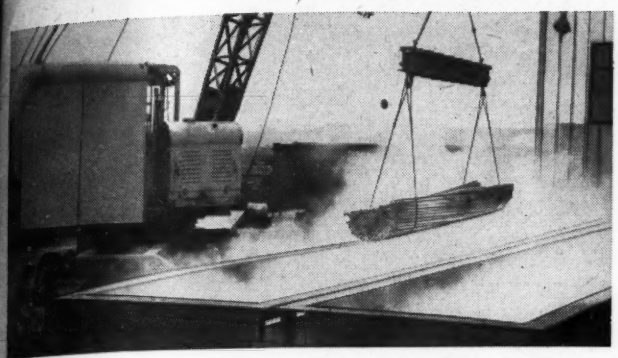
Each on-the-line welder must begin his training with a course in a company-operated school, a school conducted by a welding specialist. This course is followed by an on-the-job training period under the watchful eye of an experienced welding foreman. The new man learns that bad weather conditions can make the simplest of welds a difficult problem. At best, welding positions are never exactly ideal and many times, particularly on those welds being made in-the-ditch, cramped quarters call for special techniques. (Note the man behind the pipe in *Fig. 2,* lying on his side in the mud.)

Return to school

Several weeks and many welds later, when the foreman feels that the new man has gained sufficient experience, he is returned to school in order to pass a stiff welders' qualification test. He is now ready to take his place with the crew of on-the-line welders, returning only periodically for a refresher course. To pinpoint responsibilities on the new as well as on the more experienced, each welder uses an individual metal stamp with which he identifies his particular welds.

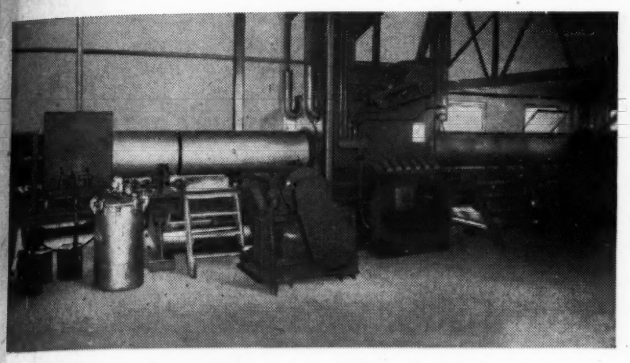
Past experience has shown Northern Indiana Public Service Co. that spot-check or sampling methods of inspections are both expensive and not completely dependable. So few potential leakers occurred in the thousands of welds made each month that any type of sampling method offered a low ratio of probability of detecting a defective weld. Each one missed could either appear as

GAS exclusive

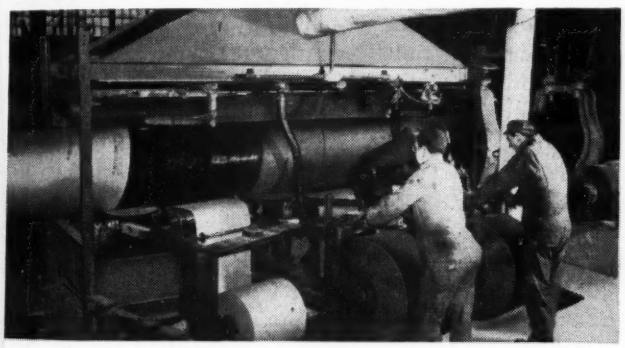


HOT CAUSTIC DIP removes all cutting oil and grease. Pipe is then rinsed in clear, hot water and dried in warming room. Throughout Hill, Hubbell process, pipe is kept at 80-90° to prevent moisture condensation.

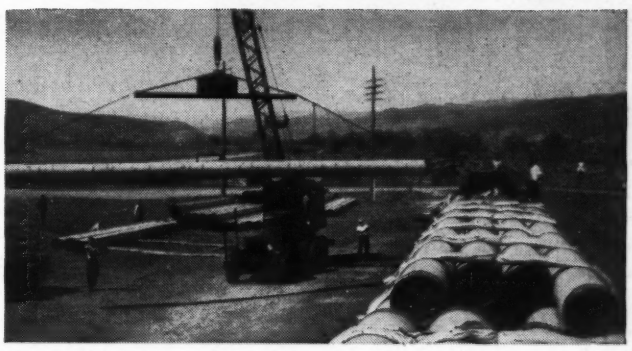
Why HILL, HUBBELL Factory-Coated Pipe Lasts Longer



ROTO GRIT BLAST removes all mill scale and rust, cleans pipe to bare, bright metal, provides a slight "tooth" to hold coatings in positive bond. Priming coat is applied immediately after Roto Grit Blast.



SECRET of Hill, Hubbell superiority is applying enamel in multiple 1/32" coats instead of one thick coat—pipe protection insurance that pays off in the field. Then pipe is tightly wrapped under even tension by special machines.



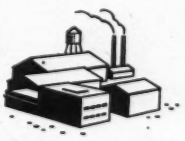
ELECTRONIC holiday detectors inspect every length of pipe before it leaves a Hill, Hubbell plant—further insurance that coatings have dielectric strength to resist electrochemical corrosion underground.

THREE HILL, HUBBELL PLANTS TO SERVE YOU:

GIRARD, OHIO
in the Youngstown Switching Zone

LORAIN, OHIO

HAMMOND, IND.
Chicago Switching Zone (in transit privileges)



Hill, Hubbell and Company
Division of GENERAL PAINT CORPORATION

Headquarters: 3091 Mayfield Road, Cleveland 18, Ohio

Pioneer in Pipe Protection for a Quarter Century

Fig. 2. Finishing pass being applied to tie-in weld on 22-in. pipeline. Two-man team work pipe from opposite sides, producing a sound weld with a minimum of stress differential.

Fig. 3. Preparing to lower a 200-ft section made up of five 40-ft lengths of 36-in. diameter pipe. This will be followed by one of the many critical tie-in welds.

Fig. 4. Section of 36-in. pipeline being lined up. External clamp will grip pipe ends firmly during first welding pass. The section is then braced until final welding passes are completed.

Fig. 5. Tie-in weld being inspected with Magnaflux. The helper, by means of a contact fixture, passes the current through the weld. The inspector applies the Magnaflux powder and notes the absence or presence of tell-tale powder build-ups.

a leaker or blowout during the final pressure tests or hold tight and open up years later as a progressive failure while the line was in service. To safeguard against this — the occasional slip of a welder—a 100% inspection was decided upon.

Inspection with Magnaflux was investigated by running series of tests under actual field conditions. It was selected for use in the program after showing its ability to locate all surface defects and any relevant sub-surface defects within any currently known standards of pipeline weld acceptance. Once the method was installed, inspection costs were sharply reduced. No longer was the inspector's time wasted in destroying perfectly good welds, and no longer was the welder's time taken up in duplicating work already completed.

First pass important

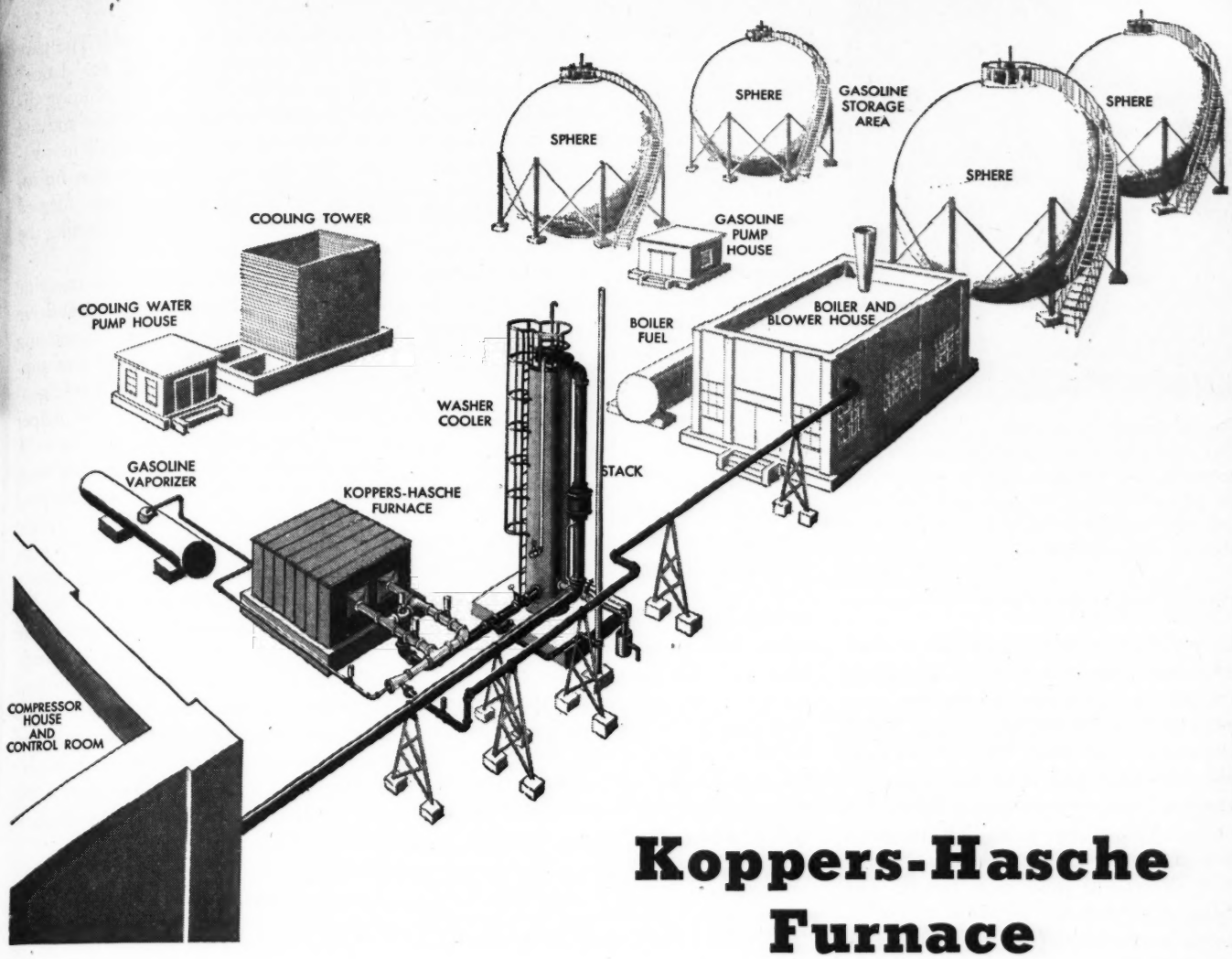
In laying the 22-in. line, Northern used random 40- to 50-ft lengths of high strength welded steel pipe with a wall thickness of 5/16 in. Internal line-up clamps were used on all but the tie-in welds because of the advantages construction-wise. With them, a fixed gap opening between lengths of pipe was easily held to the specified width.

The technique in applying the first pass or stringer bead was of the utmost importance. Only the most experienced of welders were used here, and care was exercised to obtain full penetration. No. 5 Fleetweld Rod was used. This pass was followed by a hot pass, using No. 85 Fleetweld. Finishing passes of No. 5 Fleetweld served to complete each weld on the 22-in. line. In many instances, more than a mile of pipe could be completed in a day along the edge of the ditch. Normally, lowering in by mobile cranes followed the next morning while the pipe was at a temperature approaching that of the ground.

The 36-in. diameter line presented a round of new problems. Because of its weight (it has a wall thickness of 7/16 in.), only five lengths of pipe could be lowered at any one time (see *Fig. 3*). More in-the-ditch welding was necessitated. As mentioned earlier, this very often forced the welders to assume an unnatural welding position. In *Fig. 2* the 36-in. line is being necked down to 22 in. On each in-the-ditch weld such as this, an external clamp replaced the more convenient internal type and tack welds at 3, 6, 9, and 12 o'clock were used (see *Fig. 4*). Such welds were used to temporarily secure the pipe lengths. Special caution was always exercised to see that the joining sections were braced firmly, removing the clamp. Also, special care was given to completing the stringer bead. Once the weld was completed, a quick check by Magnaflux, as in *Fig. 5*, showed the welders had once again provided a sound weld.

Inspection before lowering

Although the Magnaflux inspectors found it necessary to inspect many of the welds down in the ditch, the greater majority of them could be inspected before the pipe sections were lowered (see *Fig. 1*). In all cases, the magnetizing current was passed locally through the weld by means of a special contact prod fixture. At the same moment a cloud of finely divided magnetic particles was



Koppers-Hasche Furnace

solves your peak-load problems

THE Koppers-Hasche Reforming Process and Furnace are the result of 20 years of intensive experimental and development work. The Hasche Furnace is *unique in design,* being a thermal reforming process in which no free lampblack or carbon is produced. Gas is produced by passing a mixture of air and hydrocarbon feed stock continuously through a regenerative furnace.

The Hasche Furnace is invaluable in helping utility companies meet peak loads. Also, for industrial plants which use natural gas, as well as for utilities which distribute natural gas, this furnace is always ready to pinch hit in the event of temporary failure of the natural gas supply.

SOME PRINCIPAL FEATURES

Low Investment Cost

Extreme simplicity of process makes initial investment low compared to other types of production facilities. Savings are effected not only on furnace cost, but also on auxiliaries. Complete plant is compact, requiring relatively little ground space. Most of the equipment can be installed outdoors, saving cost of protective housing.

Low Operating Cost

Units are entirely automatic in operation, requiring minimum of operating labor and supervision. Few moving parts, thus reducing maintenance.

Low Pressure Fuel Storage

You are not limited to the use of propane with a Hasche Plant. Natural gasoline, readily available both winter and summer, is an ideal fuel to augment your natural gas supply.

For further information about the Koppers-Hasche Furnace, phone, write or wire.

KOPPERS

KOPPERS COMPANY, INC.

Engineering and Construction Division
Pittsburgh 19, Pennsylvania

Fig. 8. Defect in weld located by Magnaflux. Ground away portion reveals deep internal slag pocket. Such a weld would be replaced to prevent it from failing during the final pressure test or later, while the line is in operation.

blown directly onto the weld's surface. Discontinuities such as cracks, inclusions, or lack of penetration distort the magnetic field which has been set up within the metal. This causes the particles to be attracted and held onto the surface of the weld directly over such a defect. The action, caused by a leaking magnetic field, is similar to that of a magnet which will draw and hold iron filings. This Magnaflux powder build-up forms directly over each defect, enabling the inspector to note its exact location and extent.

Deep magnetic penetration

Low-voltage, high-ampere, half-wave current provides deep magnetic penetration. With it, the inspector is able to pass the magnetic lines of force far below the surface of the metal. These lines of force, as pictured in *Fig. 6A*, run freely through the weld unless diverted by a non-magnetic break or inclusion in the metal. If such a non-magnetic obstacle is present, the magnetic lines are forced to bypass the obstacle and, in so doing, break through the surface of the weld. This breaking through the surface is known as a magnetic leakage field. Whenever such leakage occurs (i. e., whenever magnetic lines of force enter or leave through the surface of the weld), magnetic poles are formed as in a magnet, and these poles attract and hold magnetic particles, such as Magnaflux powder.

A crack at the surface of the weld will form a sharp, well defined leakage field and, therefore, a sharp, well defined build-up (indication) of magnetic powder (see *Fig. 6B*). If the crack is below the surface, as shown in *Fig. 7A*, the powder build-up (indication) becomes broad and fuzzy (see *Fig. 7B*). A trained inspector can describe the exact nature of the defect by what he sees on the surface of the weld. Actually, his interpretation begins while the powder build-up is in the act of forming. In many cases, after locating a defect, he is called upon to suggest possible causes and to discuss them with the welder so that the welder can profit from the inspection and thereby correct his technique.

Wrong rod

As an example, in one instance on the 36-in. line, the Magnaflux inspector located powder build-ups on several welds indicating lack of weld penetration. The individual metal stamp markings, used to identify the man who had made these welds, told the inspector all welds had been made by the same man. From the nature of the indications and from his own experience as a pipeline welder, the inspector suggested that perhaps on the hot pass a larger rod had been used than that specified. He was correct. This lone welder had substituted a 3/16-in. rod for a 5/32-in. rod.

This constant 100% checking of each man's welds has proven to be a powerful influence for the betterment of Northern Indiana Public Service Co.'s welding program. It helps to reduce any let-down tendencies. Each man *knows* each of his welds will be checked.

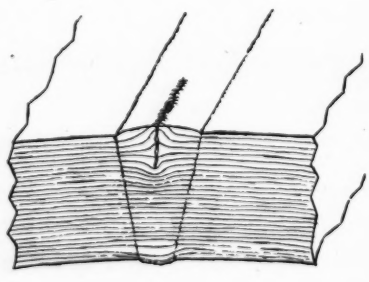
The half-wave current mentioned above is a significant development in the field of weld inspection. Being a form of direct current, it allows the magnetizing force to fully penetrate the weld. In addition, its pulsating quality activates the magnetic particles for rapid motivation by the leakage field. Unlike other d.c. sources, the particles are helped to move across the surface of the weld. The particles are actually impelled to "dance" over the defect. Thus, by combining direct current for deep penetration and the new pulsating feature for rapid motivation, the deepest of defects can be located. Powder build-ups are formed quickly and easily, thereby increasing the speed of inspection.

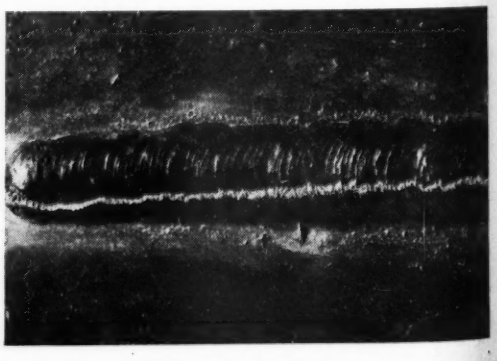
A small portable Magnaflux machine mounted on the bed of a four-wheel-drive truck furnished this special magnetizing current for the utility. Power was supplied by a gasoline-driven 220-volt generator. The inspector and his helper moved along the line from weld to weld, examining each, directly after they were made. Later, as the section was lowered into the ditch and tied in, the tie-in weld was inspected in the ditch. With his inspection equipment and power source truck-mounted, the inspector was readily available for reinspection of replacement welds, as well as for tie-ins at roads, railroads, and river crossings. Through experience in the field, Northern found that one inspection crew, composed of one inspector and one helper, was able to keep pace with 10 to 12 welders working the line, in addition to checking on tie-in welds.

Coupons cut on first welds

Initial Magnaflux powder indications on critical welds were checked for accuracy by cutting out and testing coupons destructively. The presence of slag pockets, undercuts, lack of penetration, or other defects were noted and correlated with Magnaflux indications. From then on, although an occasional coupon was taken on very questionable welds, Magnaflux was relied upon to uncover any defects which would later fail either during the final pressure test or while the welds were in service. The number of individual pressure bubble tests, origin-

Fig. 6a (left). Magnetic lines of force follow path around surface defect. **6b (right).** Leakage field formed at surface of weld attracts and holds magnetic powder in sharp, well defined build-up.

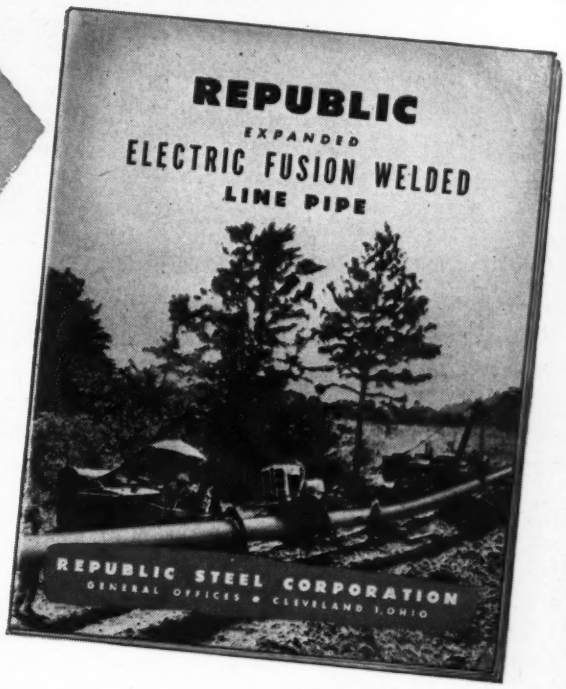




IF YOU TRANSMIT

Oil and Gas

YOU NEED THIS BOOK



● Here's the story of Republic Expanded Electric Fusion Weld Pipe. It's big pipe, designed to do big jobs. It's produced in big sizes . . . 24 through 30-inch O.D. It's the pipe that helps move oil and natural gas to new nation-wide markets.

Here . . . in 24 pages . . . are the reasons why Republic's big diameter high pressure line pipe is strong, straight, constant in circumference, uniform in wall thickness, accurate in size. Here, too, are useful tables of weights, dimensions and hydrostatic test pressures.

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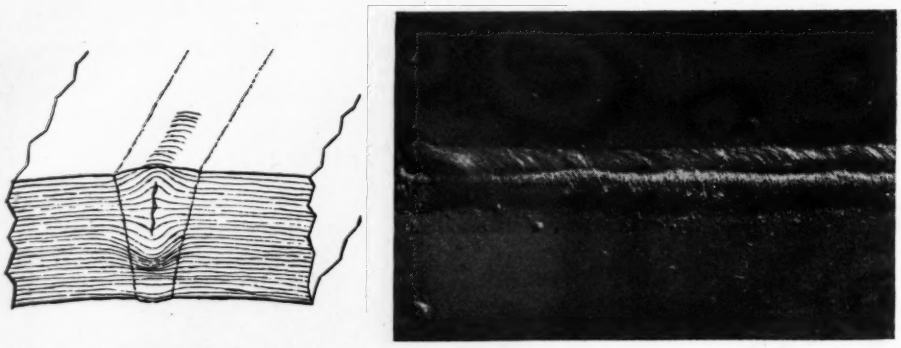


Fig. 7a (left). Magnetic lines of force follow path around sub-surface defect. **7b (right).** Leakage field formed on the surface of the weld attracts and holds magnetic powder in broad, fuzzy build-ups.

ally performed as standard procedure on each section, was reduced and finally eliminated, thereby further reducing inspection costs.

In some industries, it is fairly common to chip out defective weld areas located by Magnaflux and to repair the weld. It is also a common practice to grind out the weld to correlate the defect with the Magnaflux indication. An example is shown in *Fig. 8.* Even in metals used for high-pressure, high-temperature applications and in structures designed for repeated service stresses, it is often quite practical to remove the defect, repair the weld, and in some cases, follow by normalizing or stress relieving.

Distribution expansion

This year, Northern has included in its program the expansion of its gas distribution network in the north central Indiana area. In some cases new larger lines are being run parallel to existing small ones in order to provide new home owners, in new communities, with an adequate supply of natural gas. Construction crews move from district to district installing such lines as the one now in progress between Argos and Rochester. As many as four lines have been in progress during a single period. As the first mobile Magnaflux inspection unit was working full time to keep pace with the welders on the 36-in. trunk running into Gary, a second Magnaflux inspection unit was put into service in the South Bend district. This second mobile inspection unit skipped from one construction crew to the next since early in July of last year. As with the first inspection unit, daily reports on the quality of every weld were submitted to Mr. Ruzek in East Chicago. These reports are being retained as a permanent record for future reference.

Magnaflux in the field of pipe weld inspection is by no means new. M. W. Kellogg Co. has used it extensively on high-pressure, high-temperature piping since 1932. United Gas Pipeline and Michigan Consolidated, among others, use it for on-the-line inspection.

In addition to providing for 100% weld inspection, Magnaflux has several supplemental uses. For example, after welding it can be used to locate stray pipe lengths from "mixed" heats, such as those made of alloys exhibiting air hardening characteristics. Broad Magnaflux indications running parallel to the weld, in the parent metal, may indicate such a condition. In addition, the necessity for preheating or normalizing after welding can also be noted by a similar Magnaflux indication on the heat affected zone. Decarburization and cracking may occur in this area and result in eventual failure. Magnaflux has also been used in selecting the proper welding rod for general weldability (i. e., freedom from cracking or porosity in the weld). When inspecting on-the-job welds, rapid inspection of the critical 2-ft section of longitudinal weld adjoining each circumferential weld may also be performed. The principal function of Magnaflux inspection, however, is to prevent any let-down in welding quality.

Preventive maintenance

In addition to direct construction considerations, Northern Indiana has found that operating and maintaining a large fleet of trucks, tractors, bulldozers, cranes, and other types of mobile construction equipment has become a major problem in itself.

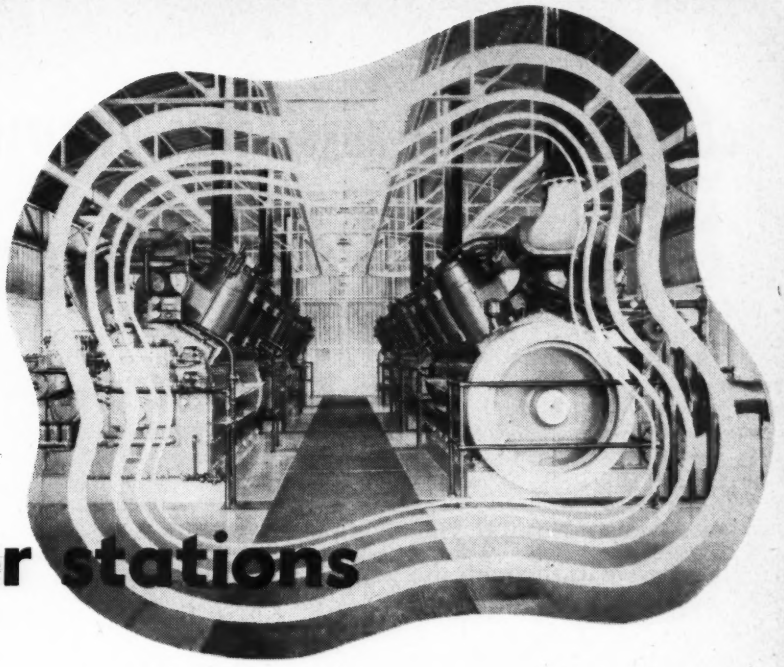
On-the-job breakdowns could cause serious delays in construction schedules. Injury to personnel could also occur. For this reason, a preventive maintenance program was planned with the majority of heavy inspection and overhaul to take place during the winter months. To assure themselves that every piece of equipment would be ready for the following spring, they planned to make Magnaflux inspection an integral part of the winter overhaul. Last year, a mild winter coupled with the determination of all employees to lay every foot of line possible, resulted in only a two-week shut-down period. This year, with two Magnaflux machines available, inspections of all mobile equipment were made. In addition, the program has been extended to critical items in pump and compressor stations. Simplified techniques for inspecting such items as valves, manways, pump and compressor parts, and critical working members of diesel and gas engines consisting of complete instructions on Magnaflux theory and its application to their various problems were initiated by engineers from Magnaflux Corp. Special training materials, including slides showing typical fatigue defects were presented, followed by the actual inspection of many of the named parts.

Proving its worth

The need for a preventive maintenance inspection program was indicated even before such a program could be formalized. Recently, an alert engineer, checking his equipment, prevented what could have been a costly breakdown. He noted a showing of oil on the rear tandem axle of a relatively new piece of heavy equipment and decided to investigate by Magnaflux inspection. On-the-spot inspection of both the rear and the forward axle (not yet leaking) showed that a number of small cracks had developed around the spring hangers. Both axles were immediately replaced by the manufacturer. In addition to the cost of the axles, Northern Indiana Public Service Co. was able to prevent many expensive hours of down-time, should either of these cracked axles have broken during operation.

Northern Indiana Public Service Co. can be justly proud of the work so far accomplished by its staff of trained specialists.* Not only are they providing customers with a more extensive and reliable gas distribution network, but by undertaking the entire program on its own, the company is providing service at the lowest possible cost to the public.

*All new gas lines are being designed by R. M. Schahfer, chief engineer; material specifications and surveying are being handled by J. M. Pickford, manager of gas engineering; and supervision of automotive equipment is under the direction of C. S. Funk, superintendent of transportation.



Reducing noise in gas compressor stations

By DR. C. A. CULVER • Southwest Research Institute, San Antonio

BECAUSE of recent court decisions favorable toward workers who suffer partial loss of hearing, and also because of impairment of efficiency due to fatigue, the problem of noise reduction in industrial plants is becoming of increasing importance. The problem is particularly acute in gas compressor stations.

It is a matter of common experience that it is practically impossible to converse when the noise level is 100 db or above. It has also been established that temporary hearing impairment results from exposure to prolonged noise levels in the region of 110 db. Permanent damage to hearing results when the level exceeds 115 db. The question is: Can existing noise levels be reduced to reasonable values and at a cost that will not be prohibitive?

This article is adapted from a talk presented at the AGA Distribution conference held in Chicago in April.

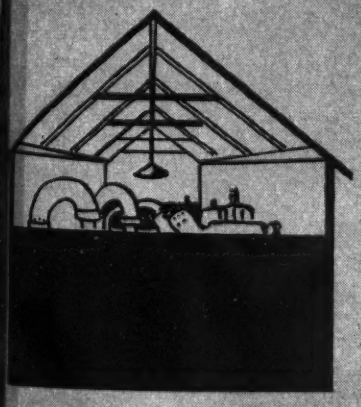
At present, there is no single formula that will provide an affirmative answer. All that can be done at this stage of our investigations is to point up the question, and to indicate one or more lines of attack.

In discussing the matter of sound, it is well to bear in mind the precise meaning and exact significance of two commonly used terms that are often confused: *sound intensity* and *loudness*. By sound intensity is meant the flow of sound energy per second through unit area, and is expressed in watts per square centimeter. In general, sound waves give rise to an alternating air pressure that varies in magnitude from about 0.0002 dyne per square centimeter for a sound that is just audible to something of the order of 200 dynes in the case of sound that is loud enough to cause physical pain. Thus the pressure change is of the order of a millionfold. The ear is thus capable of responding to sounds varying in amplitude in the ratio of 1 to 10^6, or in intensity by a ratio of 1 to 10^{12}. Fortunately the response of the ear is not linear, but follows approximately a logarithmic law, thus

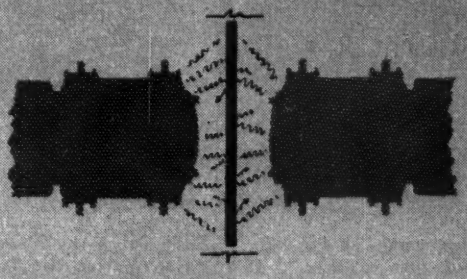
$$R = k \log I,$$

where R is the degree of response to the stimulus whose intensity is I; k is a constant. This means that to double the aural response the intensity of the sound must be increased 100 fold; to triple the

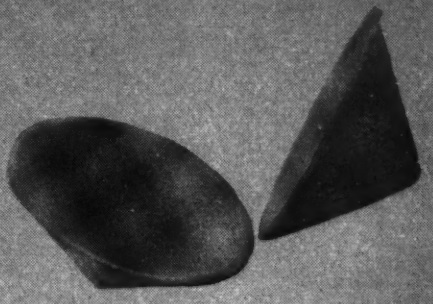
THREE RECOMMENDED METHODS OF NOISE SUPPRESSION



Half walls . . .



Sound barriers . . .



Sound-absorbing cones . . .

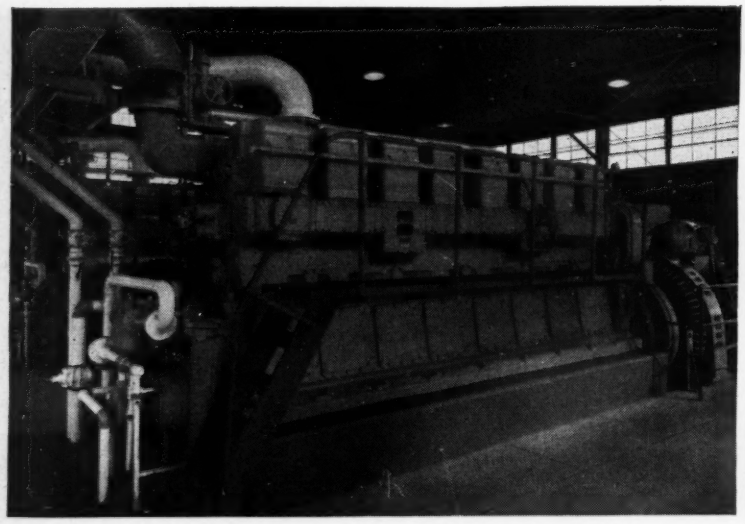
COOPER-BESSEMER HORSEPOWER MULTIPLIES 40 TIMES IN 16 YEARS

On El Paso Natural's System

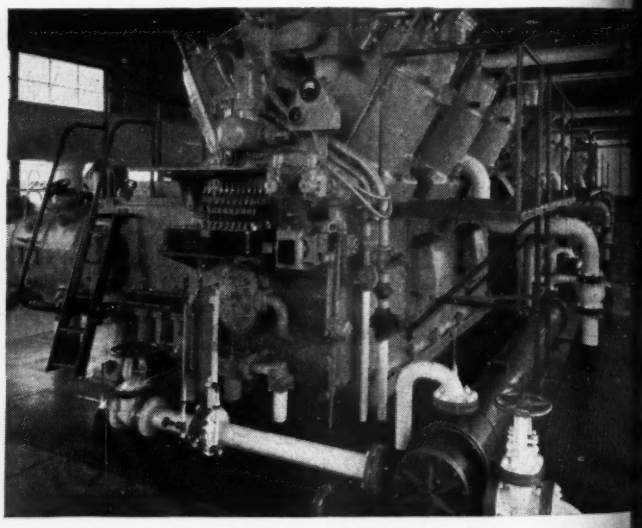
. . . AND RUNS THE GAMUT OF SERVICES!

● El Paso Natural Gas Company's remarkable growth through the years is today being climaxed by one of the largest gas pipe line expansion programs ever undertaken. If reliable, efficiently operating compressor equipment has some bearing on this success, as it must, look at the Cooper-Bessemer record . . . Back in 1937, El Paso Natural's No. 1 station was powered with Cooper-Bessemers—seven Type 19 horizontals totalling 5250 compressor horsepower. Today, Cooper-Bessemers throughout the system exceed 200,000 horsepower! And in 1940 El Paso Natural was one of the first to take advantage of a new idea in compressor design — Cooper-Bessemer V-angles. Now, these modern, compact units . . . GMV's and big GMW's alone comprise over 191,000 compressor horsepower . . . on their main lines, in gathering service, in gasoline extraction, handling residue gas and for repressuring.

Perhaps you should bear this in mind . . . with thermal efficiencies from 30 to 40 per cent, you'll find Cooper-Bessemers unmatched in fuel economy . . . unmatched, too, in the many other factors that add up to outstanding over-all economy. Why not discuss your requirements with the nearest Cooper-Bessemer office?



Rated 600 hp each, these three efficient Cooper-Bessemer JS-8 gas engines drive generators in El Paso Natural's power plant at Wasson, Texas.

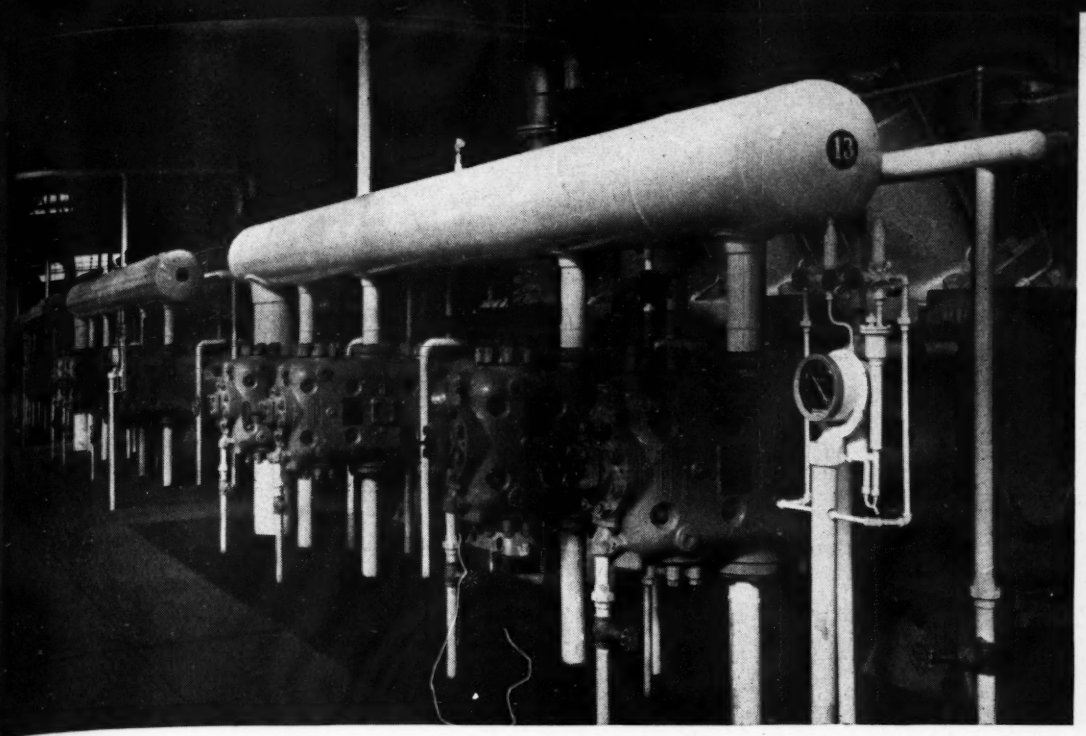


Line-up of four Cooper-Bessemer GMV-6 V-angles in El Paso Natural's gas booster station at Snyder, Texas.

by **Cooper-Bessemer**

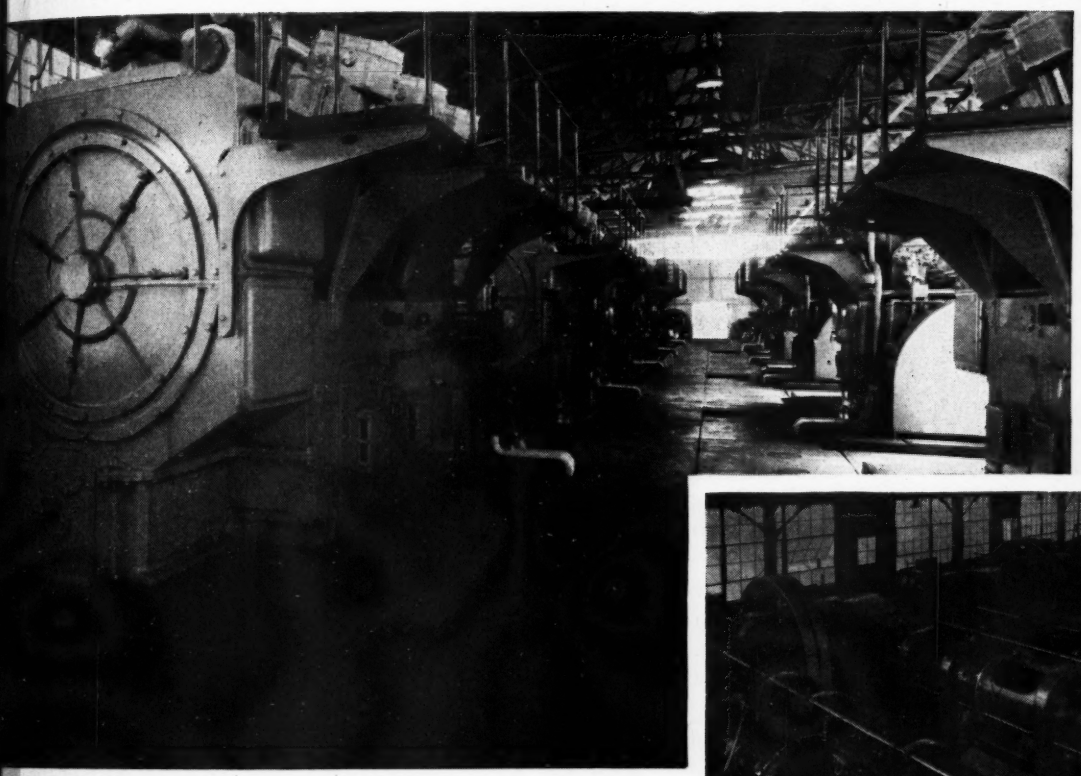
MOUNT VERNON, OHIO AND GROVE CITY, PENNA.

Tulsa Shreveport St. Louis Los Angeles Chicago



One of the latest Cooper-Bessemer V-angle installations on the El Paso Natural System — big, space-saving GMW units in the Keystone, Texas, main line gas transmission station.

Another Example of Efficient Power at Lower Cost



Line-up of seven of the seventeen GMV-10's installed from 1948 through 1950 in El Paso Natural's modern Deming station, Gage, N. M.

El Paso Natural's experience with Cooper-Bessemers started 16 years ago with this installation of seven then-modern Type 19 horizontals in their No. 1 station.

COMPRESSORS-GAS ENGINES-DIESELS

New York Washington, D. C. Bradford, Pa.

San Francisco, Cal. Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle, Wash.

TABLE 1. NOISE LEVELS COMMONLY ENCOUNTERED

Source of Sound	RMS Pressure in dynes/cm²	Intensity Level in db
Sound becomes painful	200	120
Hammer blows on steel, 2 ft	80	114
Airplane engine	50	110
Diesel engine, 2-cyl., 200 hp, 5 ft	30	105
Riveter, 35 ft	15	97
Heavy traffic	6.4	90
Noisy factory	3.6	85
Average factory	1.6	78
Ordinary conversation, 3 ft	0.36	65
Average office	0.062	50

response, the intensity must be increased by a factor of 1000, etc.

The term loudness refers to the magnitude of the *sensation* experienced by the auditor when sound waves impinge on the ear drum. But since loudness involves not only intensity but frequency and ear sensitivity, we shall confine our attention to the objective or energy aspect of the picture, i. e., intensity. Since the ear will respond to so wide a range of pressure variation, it becomes a matter of convenience to make use of a logarithmic scale in which to express relative intensities. The unit adopted for this purpose is known as the *"bel"* which denotes a tenfold change in intensity. The *"decibel"* (1/10th of a *bel*) is the unit most commonly employed in practice. The *decibel* denotes a change in intensity of 1.26 fold, 1.26 being the antilog of 0.1. On this basis two decibels would represent a change of $(1.26)^2$, three decibels $(1.26)^3$, 10 decibels (one bel) $(1.26)^{10}$. A change of one decibel represents a change in intensity of about 26%, and represents approximately the smallest change in intensity that can be detected by the ear. On the above basis the whole range of intensity to which the ear responds can thus be expressed as 12 bels or 120 db.

Relative values

Commonly, we deal with relative intensities rather than absolute values.

Change in intensity $= \log_{10} (I/I_o)$ bels or $10 \log_{10} (I/I_o)$ db. In the above equation I is the working intensity and I_o the intensity due to a standard source of sound. It has been found that for a sound whose frequency is 1000 cycles, the least acoustical power per unit area that will evoke a perceptible aural response is 10^{-10} microwatt. The corresponding wave pressure is 0.0002 dyne/cm². This intensity is, accordingly, taken as a basis in sound intensity calculations. It may, therefore, be set down that the intensity level in any given case is given by the expression $10 \log_{10} (I/10^{-10})$. On this basis a set of typical sound level values can be listed *(Table 1)*.

Having noted the terminology to be used, and the order of magnitude of the quantities involved, we may next direct our attention to the specific problem before us. And the first question that presents itself is this: What noise levels obtain in the case of gasline pumping stations? I have measured the sound level in several pumping stations. In one such station, located in the Houston area, the installation consisted of 9 UTC-168 Worthington 1600-hp units. When operating at 300 rpm the noise level on the operating floor varied from 104 db. to 106 at the ends of the units, and from 106 db to 107 db at points between the compressors, the mean being 105 db. When the rpm was advanced to 320 the sound intensity level increased, on the average, 2 db. In the basement of the same building the noise level varied from 104 db to 106 db, depending on the location.

An analysis of the noise spectrum in the station just referred to reveals several interesting and significant facts. In addition to a background of acoustical "hash" several "peaks" are present. The general background noise (hash) was found to average about 78 db. With the wave analyzer located between engine No. 9 and the end wall of the building the frequency peaks occur as shown by the first four readings in *Table 2*.

With the analyzer placed between engines No. 5 and No. 6 the results are as shown by the last four values in *Table 2*. It will be noted that the first three peaks in the second case occur at a different frequency than in the first position examined. It seems probable that the first set of readings is reasonably representative of the noise spectrum of a single engine unit, while the second group of values probably represent a composite effect. It is interesting to note that the maximum at 750 cycles is present in both cases. Between the engines the background level is high (90 db), from 750 cycles to 2500 cycles, after which the general noise level gradually drops to 77 db at 5400 cycles.

Another pumping station building in which the installation consists of 11 LPC-8 Worthington 1000-hp units showed noise levels ranging from 99 to 102 db, with maxima occurring at 75, 250, and 750 cycles.

In still another installation consisting of six UTC-168 Worthington 1600-hp units the noise level ranged from 101 to 106 db, depending on the point at which the reading was noted, the mean being 104 db.

Acoustical material used

One plant studied was of particular interest. The installation consisted of six UTC-168 Worthington 1600-hp units. The noise level originally ranged from 108 to 113 db, the average being 110. In an effort to reduce this high noise level the company operating this plant arranged to have 10,300 sq ft of wall and ceiling surfaces covered with sound absorbing material. The acoustical material consisted of two layers of 3½-in. rock wool blankets. The material on the walls extends from the upper edge of the

TABLE 2.

Frequency	Noise Level in db	Multiple of Eng. RPS
45	95	9
120	94	24
360	90	72
750	89	150
40	103	8
142	92	28.5
493	82	98.6
750	92	150

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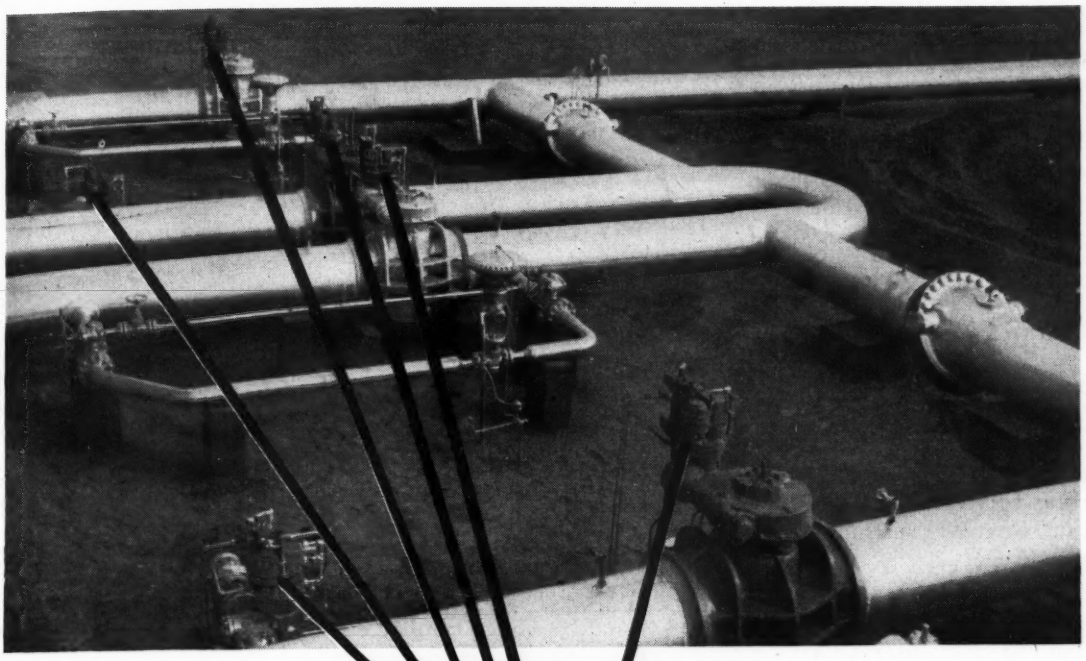

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window line to the corrulux panel under the eaves. The cost of this acoustical material, installed, was nearly $10,000. The mean sound level after the absorbing material was placed proved to be 102 db, thus showing an improvement of 8 db. The decrease in the general noise level is undoubtedly due to the elimination of the reflected sound waves from the metal walls and the ceiling now covered by the absorbing material. The primary sound generated by the compressor units, plus any noise due to vibrating pipes, still exists and accounts for the comparatively high noise level of 102 db. The supply company that installed the absorbing material expressed itself as being disappointed that the improvement was not greater.

Three sound sources

Sound energy from at least three sources simultaneously reaches any given position on the operating floor: (1) direct radiation from the machine or machines immediately adjacent to the location in question; (2) direct radiation from all other operating units in the plant; and (3) reflected radiation from the walls and ceiling. As indicated above, the reflected energy can be materially reduced, though at substantial expense.

In making an effort to reduce the reflected sound in existing buildings, a relatively new form of absorption unit has been devised. Several years ago the acoustical section of the National Bureau of Standards determined, as a result of research, that a spherical or cylindrical body of acoustically absorbing material would act with unusual effectiveness as a sound absorbing agent. This discovery has been commercialized, and the absorption units are now made in the form of hollow double cones, the material being made of shredded wood and a binder.

How cones are installed

These cones are suspended from the ceiling at a suitable distance from the working plane. In size the units range from 10 in. to 20 in. in diameter, different sized cones showing different acoustical properties. It has been found that the sound absorbing effectiveness per pound of material, when shaped as above indicated, shows a result of the order of 12 times that of the same material when used in the conventional way. For use in pumping stations the cones would need to be made of noncombustible material. Steps are being taken to determine whether it will be possible to have such units made of a material like fiberglass. The cost of such an installation would probably be less than the conventional procedure.

Sound-absorbing cones as used in an industrial application. Cones are installed in pairs. Their shape increases the sound-absorbing effectiveness of the material used by approximately 12 times.

The most direct approach to the problem is to reduce the noise having its origin in the engine-compressor units themselves. If it is assumed that these units cannot be made to operate more quietly, it then becomes necessary to consider what means might possibly be adopted whereby the several compressor units might be somewhat acoustically insulated from the room as a whole. A relatively light-weight acoustical housing could be assembled for each unit such that the noise issuing from any given unit could be reduced by at least 25 db. Such acoustical chambers could be so designed that they would be readily removable in the event it became necessary to work on the engine-compressor assembly. In those cases where the engines are air cooled, provision would have to be made for air circulation, which would, of course, reduce the sound absorbing effectiveness somewhat.

If, for operating reasons, it is considered impracticable to make use of complete enclosures, a considerable reduction in the general noise level can be brought about by the erection of "sound barriers" between the several compressor units.

Another means of reducing the general noise level would be to omit as much of the wall structure as possible. Tests show that a reduction of perhaps 10 db would result if the side walls, half way up, say, were omitted. In certain sections of the country such an arrangement might not be feasible, but in the South it could be done. Where it is applicable, this is obviously the least expensive method of reducing the noise level.

Survey it first

Whatever plan of attack is followed, one thing is quite evident, and that is that, in any given case, an acoustical survey of the plant should be made before any means are taken to apply remedial measures. Under all circumstances the magnitude of the noise level and the sound spectrum should first be determined. Only by so doing can an intelligent approach be made to the problem.

The whole problem of noise control in compressor stations might well be approached on a collective, industry-wide basis—a joint research undertaking, involving not only the gasline companies, but also the engine manufacturing organizations. We believe that a practical engineering solution of the noise problem can be found, especially if the interested companies will unite in a cooperative effort along this line.

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Type	Diameter	Length	Wall Thickness	Shipping Point
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Continuous Weld—Plain End	2⅜" to 4½" O.D.	Up to 40'	Standard	Fontana, Calif.
Electric Resistance and Fusion Weld—Plain End	14" to 18" O.D.	Up to 40'	.250" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	$5\frac{9}{16}$" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, Calif.
Electric Fusion Weld—Expanded—Plain End	20" to 30" O.D.	Up to 40'	.250" to .500"	Napa, Calif.—Basalt-Kaiser

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FPC line building permits in '52-53 close to record

The total estimated cost of gas pipeline facilities approved by the Federal Power Commission in the 12-month period ended June 30 amounts to $723,037,744, making this year second only to the peak year 1950-51 when projects costing $725,432,984 were authorized. Certificates issued for the year 1952-53 covered 7123 miles of line—the third largest mileage—and 582,715 hp in compressor units, second to the peak year's 736,135 hp.

Figures relating to the near record construction are detailed in a new official report.

Certificates issued during the first six months of 1953 covered facilities designed to add more than 2¼ billion cu ft of daily delivery capacity to the nation's transmission systems. The six months' authorizations accounted for more than half the total mileage for the year—4891—and covered facilities having a total estimated cost of $548,982,510. The larger projects (see *Table 2*), costing $700,000 or more, will benefit 69 cities of 50,000 population or over in 19 states and the District of Columbia.

Largest single project authorized is El Paso (Texas) Natural Gas Co.'s expansion program which includes 722 miles of 30-in. transmission line from Texas to Arizona; 113 miles of miscellaneous 12¾- to 26-in. loop and sales laterals; 221 miles of supply laterals in Texas; and 161,860 hp in new compressor stations and additions to existing mainline and field stations.

In the 11½ years since the present certificate provisions of the Natural Gas Act became effective, the commission has authorized construction and operation of nearly 53,000 miles of line and approximately 3.9 million hp in compressor facilities at an estimated cost of $3,886,000,000. Major facilities authorized for this period are designed to add more than 20 billion cu ft to the daily delivery capacity of the nation's pipeline systems. (See *Table 1.*)

TABLE 1. SUMMARY OF CERTIFICATES OF PUBLIC CONVENIENCE AND NECESSITY ISSUED BY FPC

(Feb. 7, 1942 and June 30, 1953)

Number of Certificates	Total Miles of Lines	Total Add'l Comp. hp	Estimated Cost
Feb. 7 - June 30, 1942			
1	20	—	$ 86,800
July 1, 1942 - June 30, 1943			
4	51	3,560	1,642,509
July 1, 1943 - June 30, 1944			
25	2,373	108,490	106,082,485
July 1, 1944 - June 30, 1945			
43	1,181	66,610	34,170,760
July 1, 1945 - June 30, 1946			
52	2,994	184,275	127,189,731
July 1, 1946 - June 30, 1947			
132	5,369	360,349	273,190,302
July 1, 1947 - June 30, 1948			
98	8,468	371,310	519,945,633
July 1, 1948 - June 30, 1949			
91	7,045	436,274	566,203,116
July 1, 1949 - June 30, 1950			
108	6,188	493,340	487,240,014
July 1, 1950 - June 30, 1951			
173	8,695	736,135	725,432,984
July 1, 1951 - June 30, 1952			
136	3,378	539,510	321,919,895
July 1, 1952 - June 30, 1953			
133	7,123	582,715	723,037,744*

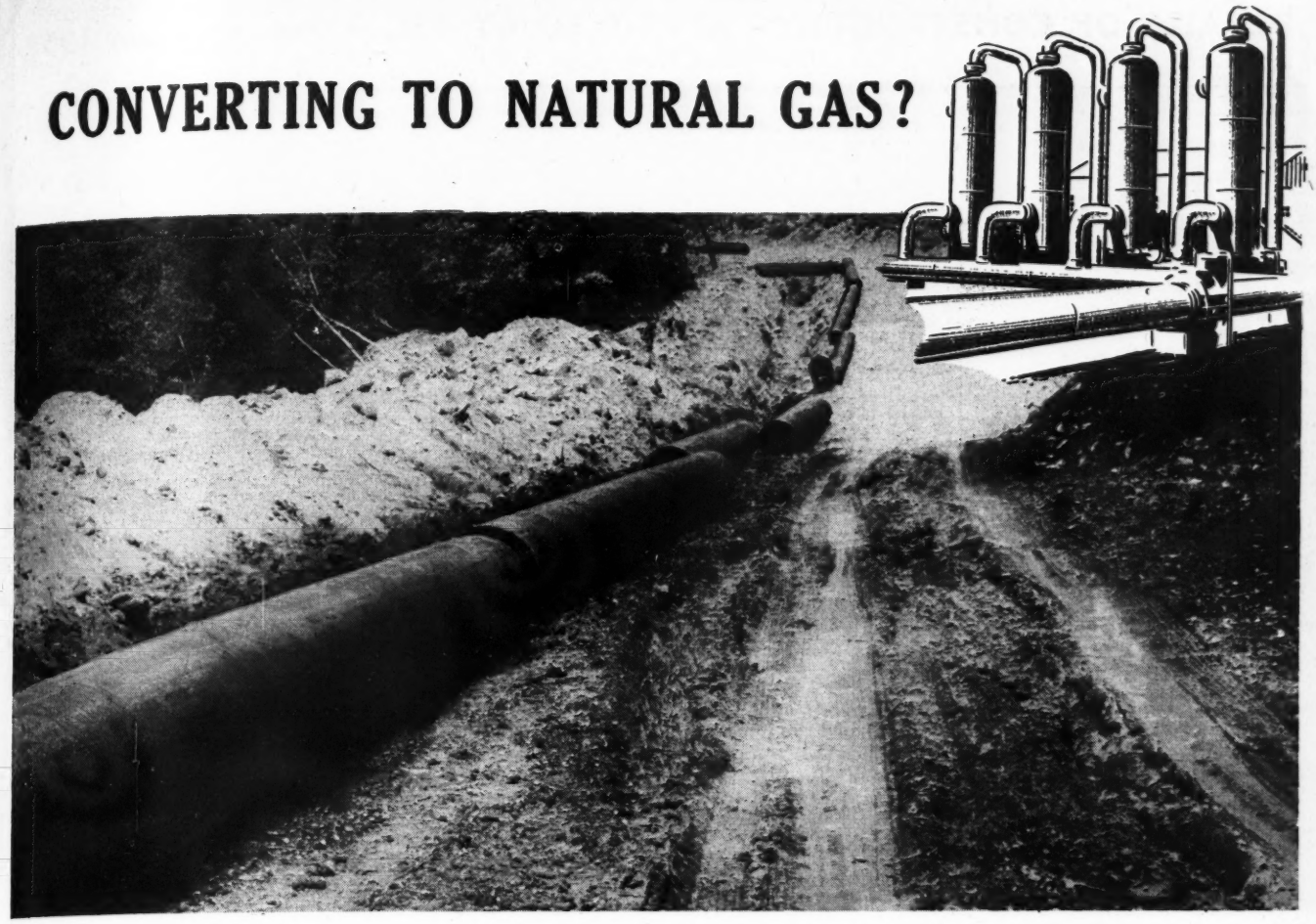
*During this 12-month period projects costing $700,000 or more each accounted for the following: certificates, 44; miles, 6684; additional compressor horsepower, 561,310; estimated cost, $706,607,251.

TABLE 2. CONSTRUCTION JOBS APPROVED BY FPC – Jan. to June 1953

Applicant and Docket No.	Description and Purpose	Estimated Cost	Communities Benefited (50,000 Population or More)
The Ohio Fuel Gas Co. G-1985 Approved Feb. 6	97 miles of 3½-in. to 20-in. storage field and connecting lines and a 6000-hp compressor station in a new storage area in Wayne, Ashland and Holmes counties, Ohio, to develop storage and insure continuity of service to existing markets.	$ 4,880,000	Ohio—Columbus, Springfield, Dayton, Toledo, Hamilton, Cincinnati.
The Ohio Fuel Gas Co. G-2013 Approved Feb. 6	35 miles of 20-in. loop line on existing line connecting with Texas Eastern Transmission Corp. near Johnstown, Ohio, to augment gas volume placed in storage during summer months and insure service on peak days to existing markets.	1,675,000	Ohio—(Same as Docket No. G-1985)
Kansas-Nebraska Natural Gas Co. Inc. G-1857 Approved Feb. 26	196 miles of 2⅜-in. to 16-in. laterals in Kansas and Nebraska and a 2000-hp addition to Scott City, Kan. compressor station to replace unserviceable smaller laterals and increase system capacity by 10 MMcf gas a day to meet increased demands of existing customers and serve new small communities.	2,576,686	Nebraska—Lincoln.
United Fuel Gas Co. G-2061-A Approved March 23*	33 miles of 24-in. transmission line connecting its system to a new storage pool in Jackson county, W. Va. to develop new storage and insure service on peak days to existing markets. (*Note: "B" facilities awaiting further commission order.)	2,531,040	District of Columbia—Washington. Kentucky—Covington, Lexington. Maryland—Baltimore, Silver Spring. New York—Binghamton, Buffalo. Ohio—(Same as Docket No. G-1985) Pennsylvania — Allentown, Bethlehem, Erie, Harrisburg, Pittsburgh, Reading, York. Virginia — Arlington, Norfolk, Portsmouth, Richmond. West Virginia—Charleston, Huntington, Wheeling.
Chicago District Pipeline Co. G-2090 Approved April 16	35 miles, 30-in. and 34-in. line into Chicago, a portion replacing a smaller diameter line, to provide a third line into Chicago and increase delivery by 100 MMcf a day to existing customers in and near Chicago.	5,500,000	Illinois—(Same as Docket No. G-1914)

(Table continued on page 150)

CONVERTING TO NATURAL GAS?



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DETAILS OF CONSTRUCTION APPROVED BY FPC — Jan. to June 1953

(Continued from page 148)

Texas-Illinois Natural Gas Pipeline Co. G-1914 Approved April 6	76 miles of 10-in. to 30-in. supply laterals, loops and river crossings in Texas, and a total of 80,000 hp in new and existing compressor stations on mainline from Texas to Illinois to increase system capacity by 130 MMcf gas a day to meet increased demands of existing customers, particularly in Chicago and vicinity.	42,158,000	Illinois—Berwyn, Chicago, Cicero, Evanston, Oak Park, Rockford. Indiana—East Chicago, Gary, Hammond, South Bend. Iowa—Cedar Rapids, Davenport.
Arkansas Louisiana Gas Co. G-1979 Approved April 29	A new 7500-hp compressor station (Beirne) in Clark county, Ark. to increase system capacity by 40 MMcf gas a day to provide continuous service to existing markets.	1,900,000	Arkansas—Little Rock.
The Ohio Fuel Gas Co. G-1787 Approved May 1	28 miles of 20-in. transmission line and 28 miles of 20-in. loop lines in Montgomery and Greene counties, Ohio, to replace and enlarge transmission lines to receive additional volumes of gas from Texas Gas Transmission Corp. and protect service to existing markets.	2,490,000	Ohio—(Same as Docket No. G-1985)
Atlantic Seaboard Corp. G-1850 Approved May 1	A total of 7640 hp in new and existing compressor stations in West Virginia to increase peak day capacity by 25.4 MMcf to meet increased demands of existing customers.	3,335,000	Maryland—Baltimore, Silver Spring. Virginia — Arlington, Richmond, Portsmouth, Norfolk. District of Columbia—Washington.
The Manufacturers Light & Heat Co., et al.* G-1893 Approved May 1	50 miles of 6-in. to 12-in. replacement and loop lines on the systems in Ohio, Pennsylvania and New York, to insure added flexibility and continuity of service to existing markets. (*Natural Gas Co. of W. Va. and Home Gas Co.)	1,898,018	New York—Binghamton, Buffalo. Pennsylvania — Allentown, Bethlehem, Erie, Harrisburg, Pittsburgh, Reading, York.
The Ohio Fuel Gas Co. G-1911 Approved May 1	33 miles of 20-in. transmission line in Crawford and Seneca counties, Ohio, to replace smaller laterals and insure continuity of service.	1,400,000	Ohio—Findlay, Tiffin, Fostoria.
Permian Basin Pipeline Co. G-1928 Approved May 1	234 miles of 16-in. to 30-in. supply lateral and transmission lines and 54,880 hp in compressor stations in the Permian basin of Texas and New Mexico to connect with the facilities of El Paso Natural Gas Co. in Yoakum county, Texas, to deliver 300 MMcf of gas from the Permian basin to El Paso Natural at Wasson, Texas, for delivery to Northern Natural Gas Co. system at Dumas, Texas.	42,530,000	Iowa—Des Moines, Sioux City. Minnesota—Minneapolis, St. Paul. Nebraska—Lincoln, Omaha.
United Fuel Gas Co. G-1952 Approved May 1	22 miles of storage field lines, 4840 hp in a new compressor station and an existing station in West Virginia to expand underground storage operations and provide more adequate service on peak days to existing markets.	2,411,600	(Same as Docket No. G-2061-A)
Northern Natural Gas Co. G-2063-A Approved May 1	259 miles of 24-in. and 30-in. loop on mainline in Texas, Kansas and Iowa and 50,400 hp in additions to existing compressor stations in Texas, Oklahoma, Nebraska and Kansas to transport 200 MMcf of gas a day in first year, to benefit existing customers on Northern's system. Note: Construction and operation of second year ("B") facilities and authorization to operate first year ("A") facilities await further hearings of the commission. See also Docket Nos. G-1928 and G-2134.	34,603,920	(Same as Docket No. G-1928)
El Paso Natural Gas Co. G-2134 Approved May 1	6850 hp additions to Plains and Dimmitt, Texas, compressor stations to receive gas from Permian Basin Pipeline Co., near Wasson, in Yoakum county, Texas, and transport and deliver same volumes to Northern Natural Gas Co., near Dumas, in Moore county, Texas.	2,562,500	(Same as Docket No. G-1928)
Southern Natural Gas Co. G-1907-B Approved May 4*	130 miles of 16-in. transmission line from Bass Junction, Ga. to Aiken, S. C.; 120 miles of 14-in. transmission line from Wrens, Ga. to Savannah; 522 miles of 14-in. to 24-in. transmission and lateral loop lines; 20 miles of 4½-in. laterals, and 14,200 hp in new and existing compressor stations to increase sales capacity by 350 MMcf gas a day to meet increased demands of existing customers and new communities in Georgia, Alabama, and South Carolina. *("A" portion authorized—Oct. 31, 1952)	44,932,600	Alabama—Montgomery, Birmingham. Georgia — Atlanta, Macon, Columbus, Savannah. Mississippi—Jackson. South Carolina—Columbia, Charleston.
South Carolina Natural Gas Co. G-1961 Approved May 4	160 miles of 10-in. to 16-in. lines from a connection with Southern Natural Gas Co. near Aiken, S. C. to communities in southeastern South Carolina to receive 30 MMcf of gas a day from Southern Natural.	5,945,000	South Carolina—Columbia, Charleston.
Gulf Interstate Gas Co. G-2058 Approved May 20	860 miles of 30-in. mainline from southern Louisiana to a connection with United Fuel Gas Co. in Boyd county, Ky.; 229 miles of 12½-in. to 24-in. main supply laterals, and 85 miles of smaller laterals in Louisiana, and 40,000 hp in five compressor stations on the mainline to transport up to 375 MMcf of gas a day for United Fuel Gas Co. to meet increased demands of markets served by the Columbia system companies.	129,541,000	(Same as Docket No. G-2061-A)
El Paso Natural Gas Co. G-2106 Approved June 29	722 miles of 30-in. transmission line from Permian basin to Kingman, Ariz.; 95 miles of 16-in. to 26-in. loops; 221 miles of 12¾-in. to 30-in. supply laterals in Texas; an 18-mile, 12¾-in. lateral in Phoenix, Ariz. area, and 161,860 hp in new and existing mainline and field compressor stations to increase system capacity by 405 MMcf of gas a day for 304 MMcf increase in deliveries to Southern California Gas Co. and Pacific Gas & Electric Co. in California, and for customers in west Texas, New Mexico and Arizona.	175,250,000	Arizona—Phoenix. California — Los Angeles, Long Beach, Glendale, Pasadena, Santa Monica, San Diego, Berkeley, Fresno, Oakland, Sacramento, San Francisco, San Jose, Stockton.
Southern California Gas Co. and Southern Counties Gas Co. of Calif. G-2104 Approved June 29	73 miles of 30-in. loop on Los Angeles line and 5280 hp addition to Blythe compressor station to receive and transport 152 MMcf additional gas a day from El Paso Natural Gas Co. to meet increased demands of existing customers and replace diminishing local supplies.	7,482,194	California — Long Beach, Los Angeles, Glendale, Pasadena, Santa Monica, San Diego.
Pacific Gas & Electric Co. G-2102 Approved June 29	220 miles of 34-in. loops on the Topock-Milpitas mainline, 7 miles of 30-in. loop on the Irvington, Calif. line and addition of 2500 hp at Topock station to receive and transport 152 MMcf of additional gas a day from El Paso Natural Gas Co. to meet increased requirements of existing customers and replace diminishing local supplies.	26,721,435	California — Berkeley, Fresno, Oakland, Sacramento, San Francisco, San Jose, Stockton.

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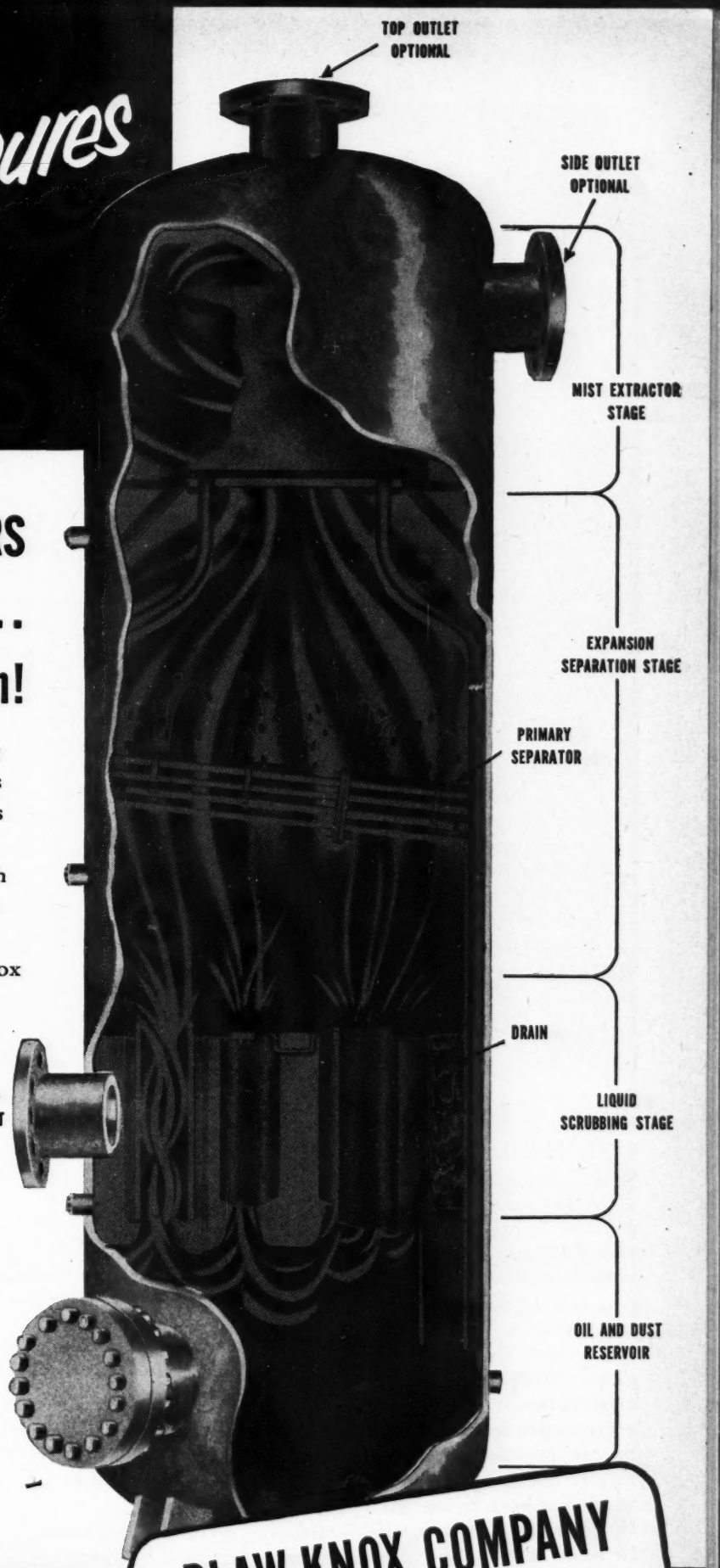
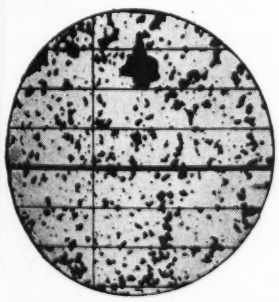


HOW BIG IS A MICRON?



In this photomicrograph at 200 magnifications the narrow lines are one micron wide. Note that many dust particles are even smaller. For complete information on Blaw-Knox Gas Equipment and the subject of pipe line dust, write for Bulletin 2353.

BLAW-KNOX

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A new desiccant for drying natural gas: activated alumina gel

By ROBERT J. GETTY, C. E. LAMB, and WAYNE C. MONTGOMERY*

One of the most common methods of removing water from a fluid stream is by the use of a solid desiccant contained in a drying tower. There are many designs of such drying towers available but the principles of operation are similar. In any of these towers, the wet gas enters a bed of solid desiccant of sufficient depth to remove the water in the gas by contact adsorption. Dry gas emerges from the effluent end of the desiccant bed for varying periods of time. The time of operation depends on several factors such as temperature, gas velocity, water content of gas, moisture holding capacity of the desiccant, and depth of desiccant bed. The water adsorption has been shown to occur in a so-called "zone of adsorption," which moves progressively through the bed. When this zone reaches the exit end of the bed, the moisture content of the effluent gas begins a fairly rapid rise. This point has been labeled the "break-point." Within a fairly short time after the break-point, it is necessary to divert the gas flow to another tower containing freshly activated desiccant. After the removal of the adsorbed water by heating, the desiccant is again ready to go about its job of drying gas. Therefore, because of the cyclic nature of operation, it is customary to have two or more drying towers operating in parallel, with one tower going through the reactivation cycle, and at least one on the drying cycle, at all times. In many fields of operation, the desiccant can be used for thousands of these cycles and still do a satisfactory job of water removal. In fact, the first activated alumina, Grade F, ever sold by Aluminum Co. of America more than 20 years ago, is still in use. In other fields, such as the dehydration of natural gas, the desiccant will experience a decline of capacity with use, and the "life" of the desiccant will be important economically. Thus, it can be seen that a desiccant of high moisture holding capacity, and high retention of this capacity in use, would be the most desirable. A new product, activated alumina H-151, gives great promise of filling these needs most ably.

*Mr. Getty is with the Aluminum Research Laboratories, E. St. Louis, Ill.; Mr. Lamb is with Continental Oil Co., Lafayette, La.; and Mr. Montgomery is with the Aluminum Co. of America, New Orleans.

This article is adapted from a paper presented at the Gas Hydrate Control Conference held at the University of Oklahoma in May.

History of H-151

EXPERIMENTAL work has been carried out by Alcoa for a number of years on the manufacture of a gel-type alumina. Briefly, this manufacture consists of the mixing of sodium aluminate solution with sodium bicarbonate solution, and the filtration, washing, drying, and activation of the gelatinous mass thus formed. This new material has been given the designation, Activated Alumina, H-type. Pilot plant batches of this gel-type alumina have shown a marked increase in water sorptive capacity over that of the F-type activated alumina, which has been in use for some time. However, the H-type material in granular form did not prove satisfactory since it showed excessive particle breakdown.

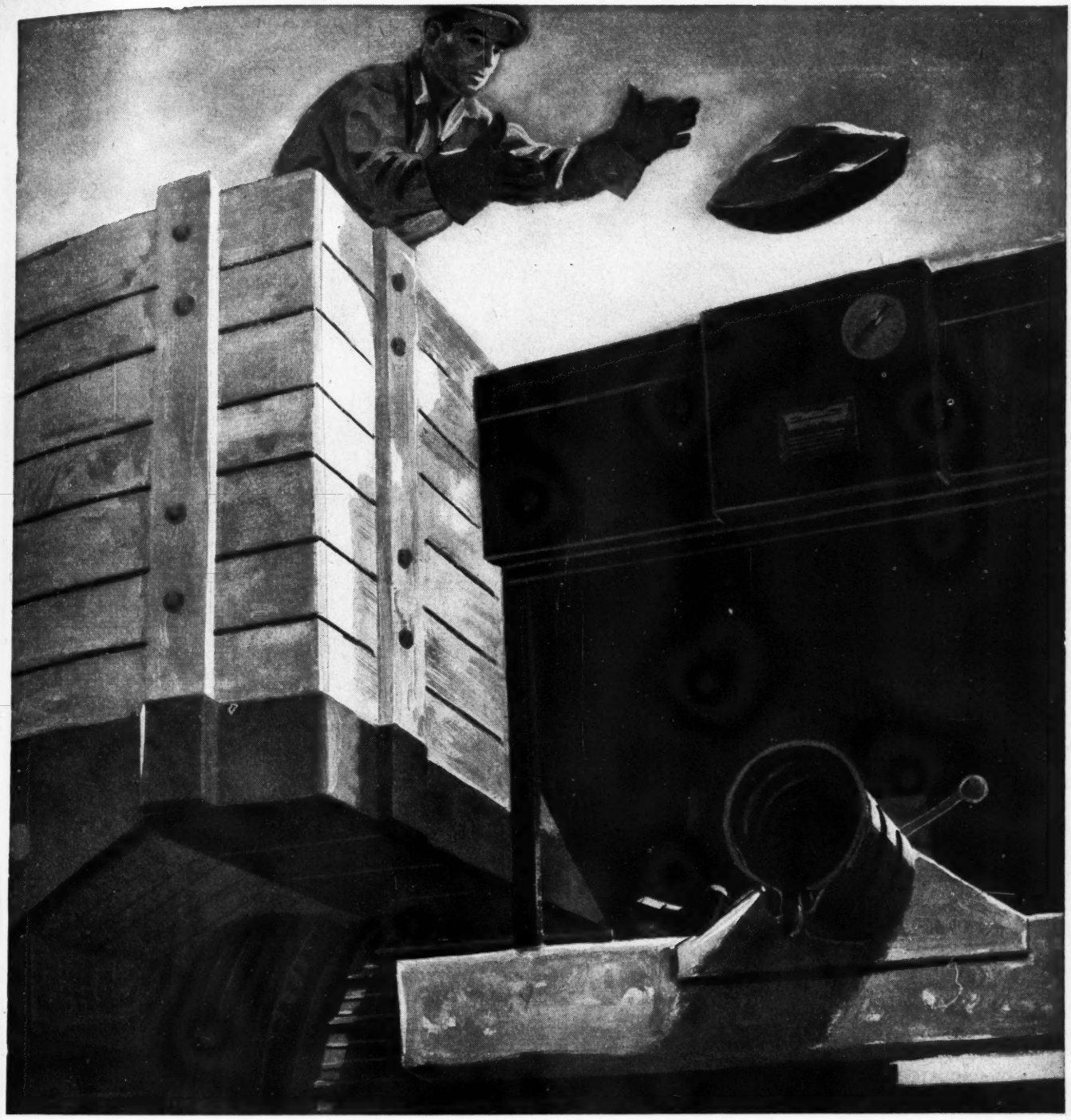
In order to overcome this weakness and to obtain other desired characteristics, for several years considerable work was devoted to ball-forming this gel-type alumina. The result was a product of superior physical properties. This successful accomplishment, along with the high sorptive capacities found for the gel-type material, has indicated that alumina gel balls would be very well suited to the drying of high pressure fluid streams, such as natural gas. However, before releasing this product, designated activated alumina H-151, to the market, it was considered advisable to conduct a comparative test with the competing gel desiccant under actual field conditions.

The installation

This field test was made at the Reddell separator station of Continental Oil Co., located four miles northwest of Reddell, La. This separator station receives natural gas from 17 wells in the area, with the average pressure at the well site being 2400 psi. The normal flow from this field averages 16 to 19 million scf per day. Upon arrival at the separator station, the gas is expanded to approximately 850 psi. It then enters a number of separators where free water and distillate are removed.

The gas streams from the individual separators are combined and flow through a master separator where any additional liquid is removed. At this point the gas is free of any liquid, but is saturated with water and distillate vapors at the prevailing conditions of temperature and pressure. The gas stream then passes through the dehydration tower, where the water is removed by the solid desiccant. The dried gas is metered and then recombined with the distillate for transmission to a gasoline plant.

A twin-tower dehydration unit was used for this test. Each tower of this unit is 16 ft high and 3 ft in diameter. Wet gas enters the tower at the bottom through a 4-in. pipe, which extends above the top of the bed through the



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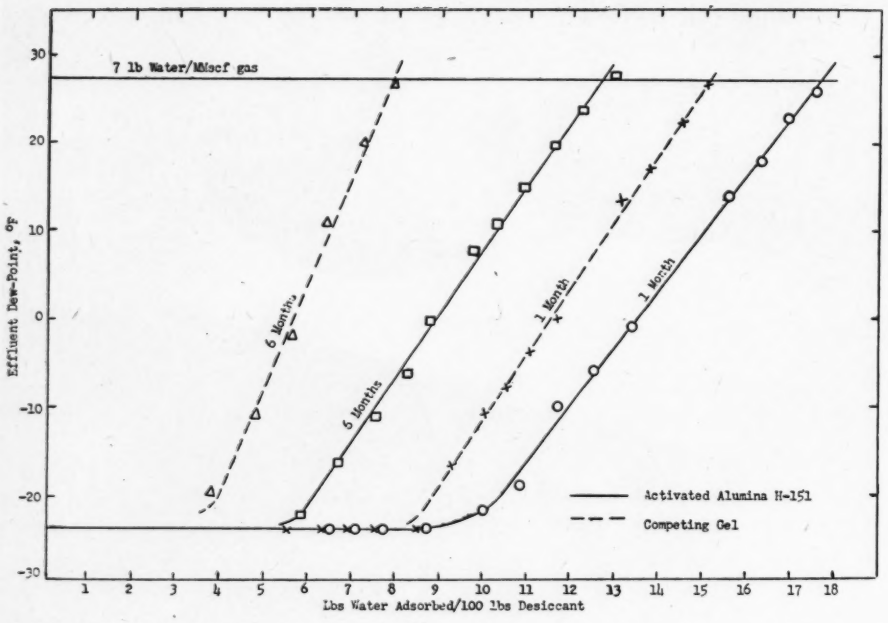


Fig. 1. Capacity test data for activated aulmina H-151 vs. competing gel (data for 1 month and 6 months' tests).

centerline of the tower. The gas is deflected downward through the bed by a bonnet at the top of this pipe. The dried gas leaves at the bottom of the tower.

Reactivation of the spent desiccant is accomplished by passing natural gas heated to approximately 360° F through the bed, counter-current to the flow of the drying cycle. In normal operation, the towers at Reddell are switched every eight hours. A tower is reactivated for six hours and cooled for two hours before being placed on the drying part of the cycle.

Test procedure

On April 11, 1951, one tower of this unit was charged with approximately 4000 lb of the competing gel desiccant, 4-8 mesh size. Approximately the upper 10% of the bed was filled with a new form of the competitive gel, said to show high resistance to decrepitation when in contact with liquid water. The other tower was charged with 3900 lb (equivalent height) of H-151 Activated Alumina gel balls, ¼ in. to 6 mesh.[1]

The first test was made on April 14, 1951, after the beds had completed several normal drying cycles. For a test, the particular tower being tested was allowed to continue on stream without interruption until the water content of the effluent gas had gone above 7 lb per MMscf. This quantity of water vapor is usually the standard allowable in the gas transmission industry, and will be taken as the basis of comparison for these tests.

During a run, the water vapor contents of the inlet and the outlet gas from the dehydrator were determined at periodic intervals. The water content of the inlet gas was determined by the inlet temperature and pressure, and by assuming that the gas was saturated at this temperature and pressure. The water content of the outlet gas was determined by its dew-point and pressure. Dew-points were determined by the use of a Bureau of Mines high pressure dew-point tester, using liquid propane as the coolant. The absolute water contents in pounds per MMscf were derived from a chart of water vapor content at saturation vs. temperature at various pressures.[2]

Gas flows were calculated from the readings on the orifice meter chart by the method given in a booklet by American Meter Co.[3]

Capacity test runs were made on each tower a total of six different times. In addition to the data taken shortly after charging the towers, test runs were made after approximately 1, 3, 6, 13, and 20 months of operation.

On two different occasions, once after one month's operation, and again after six months' operation, the towers were opened and samples of the desiccant material removed from the top of the beds. These samples were returned to Alcoa's Aluminum Research Laboratories for screen analysis and determination of crushing strength.

Data and results

Fig. 1 presents the detailed data for two runs each on H-151 and the competing gel tested. In this plot, calculated capacity, or percent adsorbed, is plotted versus effluent dew-points.

A summary of the capacity data through 20 months of operation is presented in *Table 1* and graphically in *Fig. 2*. Seven pounds of water per 1 MMscf of gas, which corresponds to a dew-point of approximately 27.5° F at these conditions of temperature and pressure, has been selected as the parameter for this summary.

The results of screen analyses and crushing strength determinations on the samples removed from the towers at the one and six months' points are given in *Table 2*. *Fig. 3* presents graphically the amount of breakdown of the two materials.

Discussion of results

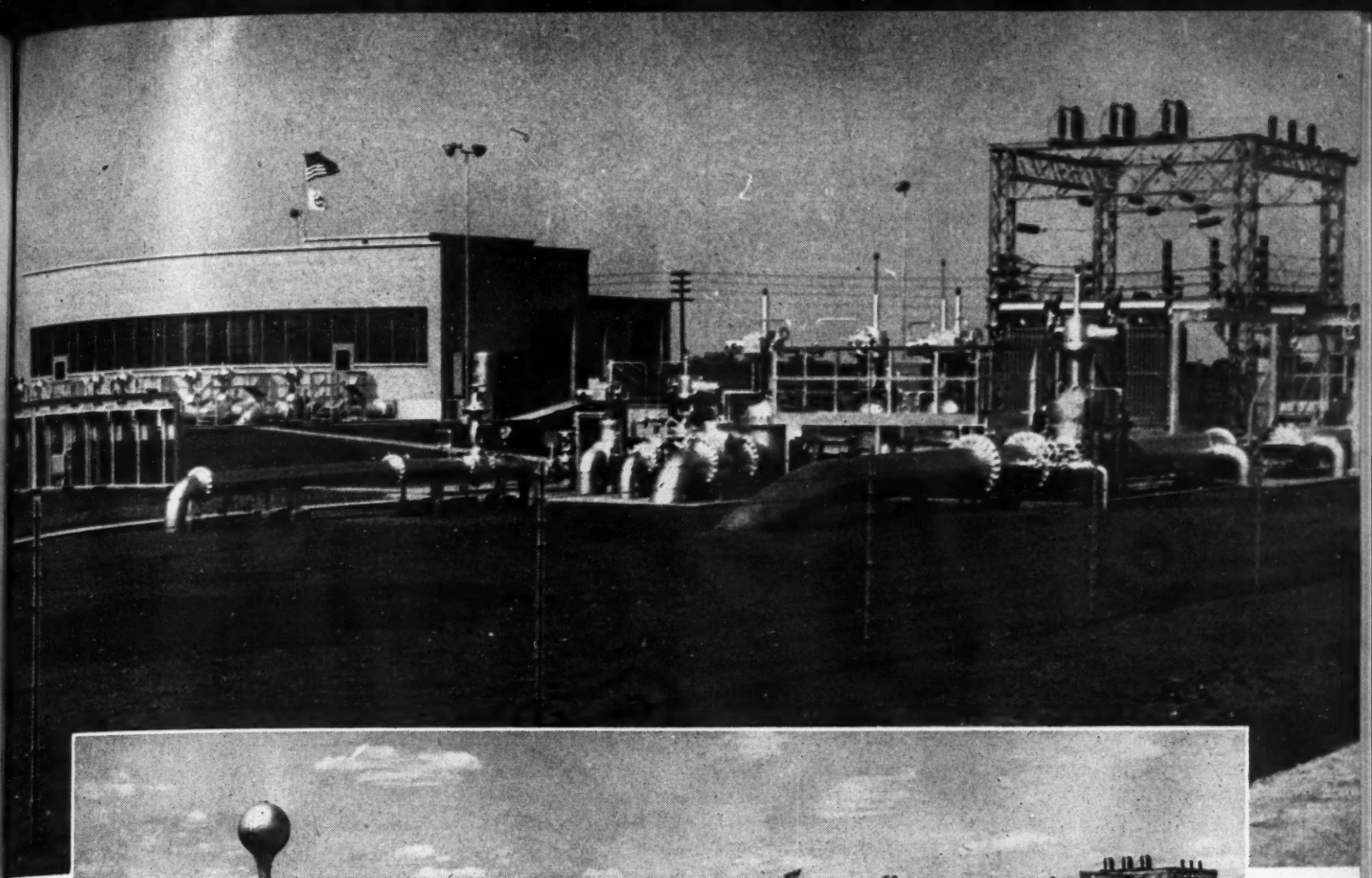
It can be seen from *Fig. 1* that the typical run consisted of a fairly long period of constant effluent dew-point, which for all runs was below —20° F; a "break-point," when the adsorption "front" reached the exit end of the bed; and then a period of constant rise in dew-point. Curves of this type were made for all the test runs but are not included in *Fig. 1* in order to keep it readable. The point at which the effluent dew-point curve crosses the line for 7-lb water per MMscf was taken as the parameter for comparing the data in *Table 1* and in *Fig. 2*.

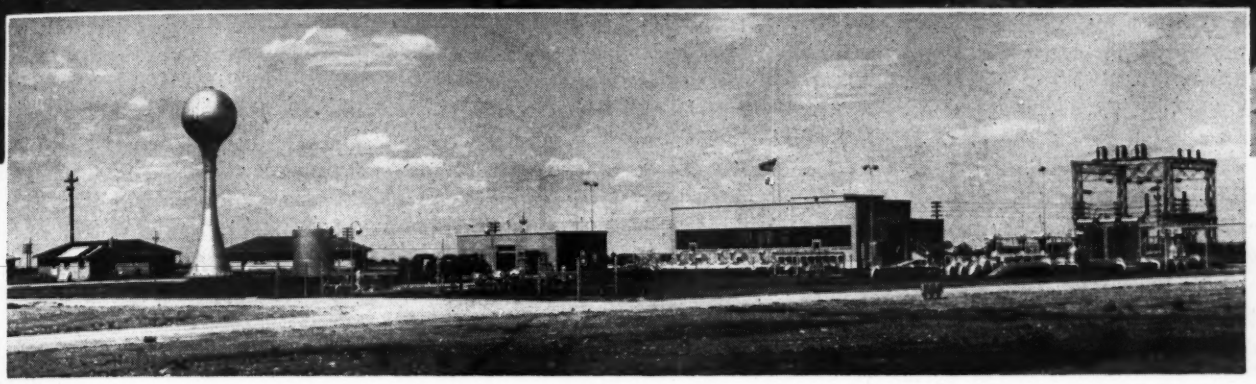
Fig. 2 really tells the story, as it presents graphically the life histories of the two desiccants, so far as capacity is concerned. It can be seen that both desiccants started off with approximately the same sorptive capacity and that both experienced a decline in capacity for the first six months. This rate of decline was much greater for the competing gel than for H-151, with the result that after six months of operation, the capacity of the H-151 was 12.7%, whereas that of the other gel was only 7.9%. The curves for both desiccants then began leveling out, with practically no further decrease in capacity for the H-151 through the 20 months' point, and only

[1]The material charged to the tower was originally designated as XH-151 because it was produced in the pilot plant and was not in commercial production at the time of charging.

[2]McCarthy, E. L.; Boyd, W. L.; and Reid, L. S.; "Water Vapor Content of Natural Gas at Saturation," presented at San Antonio meeting of AIME, Petroleum Branch, Oct. 5, 1949.

[3]"Orifice Meter Constants," Handbook E-2, American Meter Co., Erie, Pa.





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Date of Test	Months of Operation	% Adsorbed* H-151	% Adsorbed* Competing Gel
April 1951	0.1	18.8	19.0
May 1951	1.2	17.6	15.2
July 1951	3.3	14.9	10.8
October 1951	6.2	12.7	7.9
May 1952	13.0	12.8	10.0
December 1952	20.0	12.5	7.0

*Percent adsorbed to bring the gas to not over 7-lb water per MMscf.

Table 1. Sorptive capacity data on H-151 vs. competing gel.

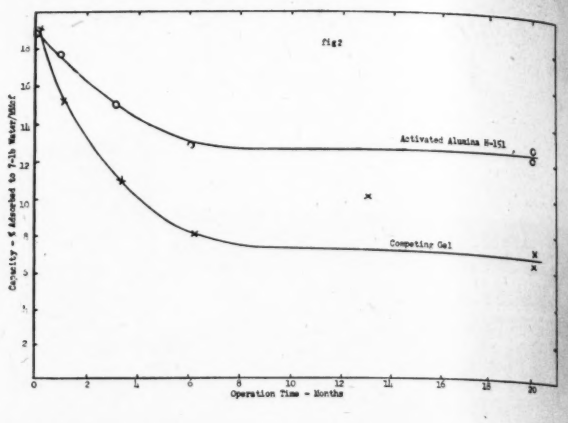


Fig. 2. Sorptive capacity vs. time of operation.

a small decrease for the competitive gel desiccant.

The data for the 13 months' test run were disregarded when the performance curve *(Fig. 2)* was drawn. When this test was made, the Reddell unit was operating at a flow rate of only 10 to 11 MMcf of gas per day, whereas normal flow was approximately 16 to 18 MMcf per day. Another peculiarity of this test was the low inlet gas temperature. This temperature was as low as 68.5° F during this time, as compared to an average inlet gas temperature for the other runs of 82-84° F. This lower temperature, of course, meant less water per cubic foot of gas. The combination of decreased flow and decreased water content of the gas caused the water entering the bed to drop to only about 40% of that entering normally. The data for this test run can therefore be disregarded, as the conditions of the test were not representative. The flow for the H-151 run during the 13 months' test was closer to normal than for the competing gel run, and the point representing this run falls correspondingly closer to the over-all performance curve.

It will be noticed from *Fig. 2* that two runs were made for each tower after 20 months of operation. The data within each set provide good checks with one another. During these latter tests the flow rates for both of the competing gel runs were held constant at approximately 16 MMcf gas per day. For the two runs on H-151, the flow rates both averaged 19.4 MMcf per day. This higher flow rate had no deleterious effect on the capacity of the H-151.

After 20 months of operation, the capacity of the H-151 was 12.5%, and the capacity of the competing gel was 7.0%. The capacity of the H-151 was therefore approximately 80% greater than that for the other gel tested. This higher capacity for H-151 would enable existing units to run for longer cycles, with a corresponding decrease in reactivation cost, or at higher capacity, which would allow additional wells to be brought in. It would also allow the design of smaller sized drying towers for the new units on

Mesh Size	H-151 As Charged %	H-151 After One Month Service %	H-151 After Six Months Service %	Competing Gel As Charged %	Competing Gel After One Month Service %	Competing Gel After Six Months Service %
4 Mesh	82.0	84.9	70.8	9.2	0.0	0.0
4-8	17.9	14.3	24.8	90.3	29.5	12.1
8-14	0.03	0.76	4.3	0.5	59.5	64.7
14-20	0.01	0.02	0.1	0.0	6.8	16.8
20-28	0.01	0.01	0.01	0.0	2.65	4.2
28-42	0.01	0.01	0.0	0.0	1.23	1.5
-42	0.01	0.03	0.04	0.0	0.36	0.8
Total	99.97	100.03	100.05	100.0	100.04	100.0
Crushing Strength, %	55.1	45.0	45.2	64.1	29.6	30.8

Table 2. Particle breakdown and crushing strength of samples.

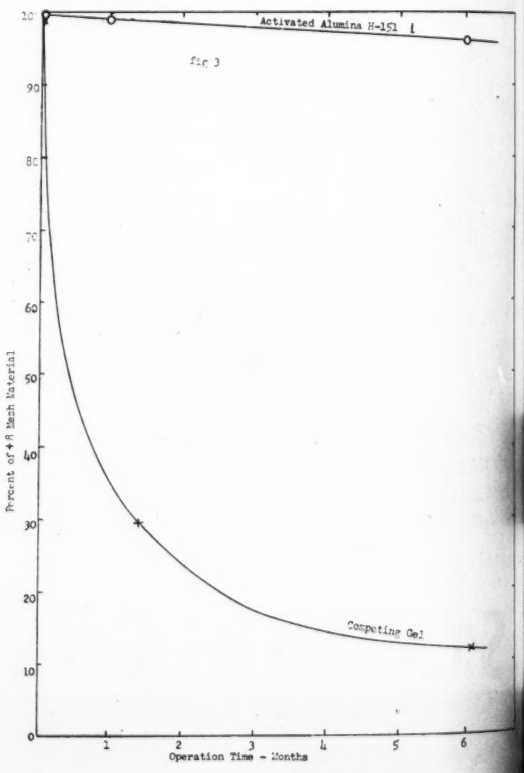
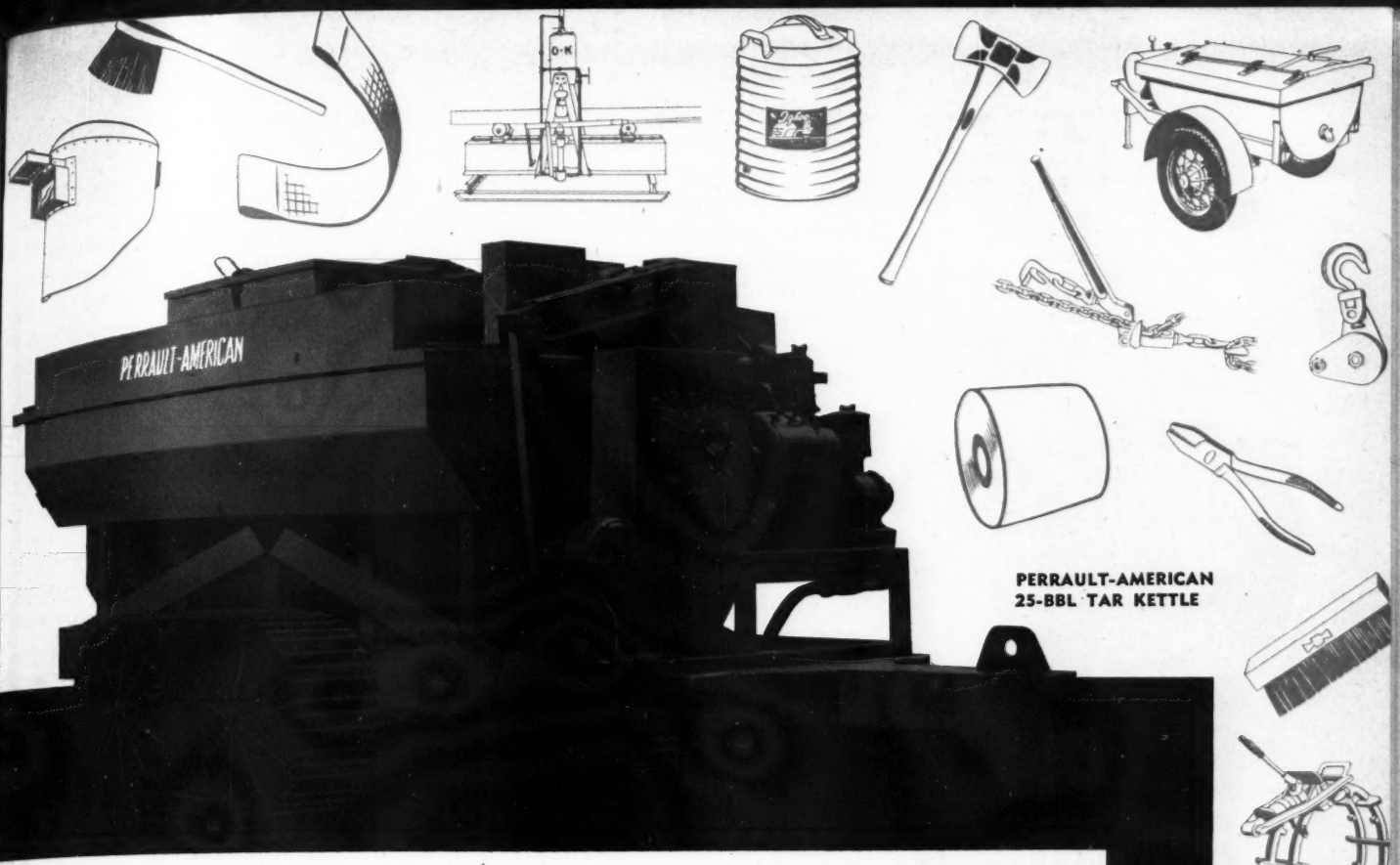


Fig. 3. Disintegration of desiccants at inlet side.



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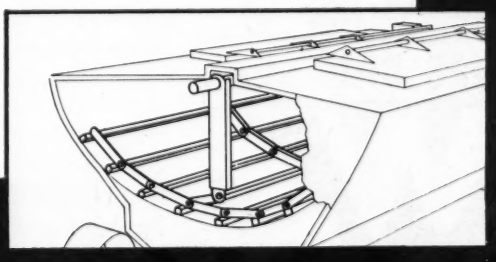

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a particular job. Any of these, of course, would represent real savings.

It is interesting to note that the 7.0% capacity for the competing gel after leveling out is very close to the 7.5% capacity figure for this material, used by many design engineers when specifying equipment. The gas dried at this installation is a typical Gulf Coast gas, containing approximately 90% methane by volume. The fouling characteristics of this gas can be considered about average as evidenced by the 7.0% capacity for the competitive gel after leveling out.

Because of the setup at this particular separator station, where the distillate recovered is recombined with the dried gas for transmission to a gasoline plant, no study of the distillate recoveries of the two types of desiccants could be made.

As stated previously, the towers were blown down and opened for sample removal at the end of one month and again at six months. A visual examination of the material in the top of the beds showed that the competing gel had broken into relatively small pieces, whereas the H-151 balls had suffered little or no breakage. This fact is borne out in the screen analyses of these samples, along with that of the material as charged, which appear in *Table 2*. These data are graphically presented in *Fig. 3*, which demonstrates the minor breakdown of the H-151 gel balls as compared to the other gel. It is seen that at the end of six months' operation, over 95% of the H-151 was still larger than 8 mesh, whereas only 12% of the competitive gel could make this claim.

It is to be emphasized that the other type gel charged to the top of the tower, and from which these samples were taken, is the relatively new form which is supposed to resist decrepitation from liquid water. In beaker tests conducted in the laboratory, approximately 75% of fresh particles of the new form of the competing gel showed breakage or cracking after three wettings with water and alternate dryings in room air. The presence of hydrocarbons before the water wetting was found to accentuate this breaking, and caused essentially all the particles to break within a few reactivation and wetting cycles. The turbulent motion of the incoming gas stream could then break the cracked particles into the small fragments that were present in the top of the tower.

This particle breakage is important because of the resulting large pressure drop through equipment containing small particles. There is no way of measuring the actual pressure drop through the beds at this installation. However, there are pressure taps available upstream, and at some distance downstream from the dehydrating towers. At the time of the six months test, these pressures were measured during the runs on each tower with the same calibrated pressure gauge. The pressure drops so measured were found to be 60 psi and 35 psi for the competing gel and H-151 beds, respectively. If the pressure drop through the piping, elbows, flanges, orifice plate, valves, entrance and exit losses, etc., can be assumed to be approximately 25 psi, this would mean that the pressure drops through the actual beds were 35 psi for the competitive gel and 10 psi for the H-151. This difference could mean increased pumping costs in some installations.

The crushing strengths of the samples removed from the towers are also listed in *Table 2*. The test for this property consists of subjecting a weighed sample of 4-8 mesh material to a pressure of 1000 psi for one minute, and then measuring the amount of plus 8 mesh material remaining. The ratio of the weight of this fraction to the original weight is called crushing strength, and is expressed in percent. Alcoa's desiccant, H-151, had an original crushing strength of 55%, dropped to 45% in one month, and was still the same after six months. The percent decrease in crushing strength was therefore approximately 18%. The competing gel, as charged, had a crushing strength of 64%. At the one and six months' points of operation, the crushing strength of the competing gel had dropped to approximately 30%; this represented a 53% decrease from its original crushing strength.

The towers have not been opened for material inspection since the six months' test. Inasmuch as only the top level of the bed can be sampled, it was felt that little could be gained by extracting further samples until the whole bed could be sampled. This will probably not occur until the desiccants in the towers are no longer able to meet the specifications required of the gas at this installation. Having been designed for a lower capacity desiccant, these towers are still able to give satisfactory performance, even with the large decrease in capacity noted for the tower containing the competing gel. When the final test run is made, and the towers are emptied, additional useful information should be gained. It appears, however, that the H-151 is set for a very long life at its present level.

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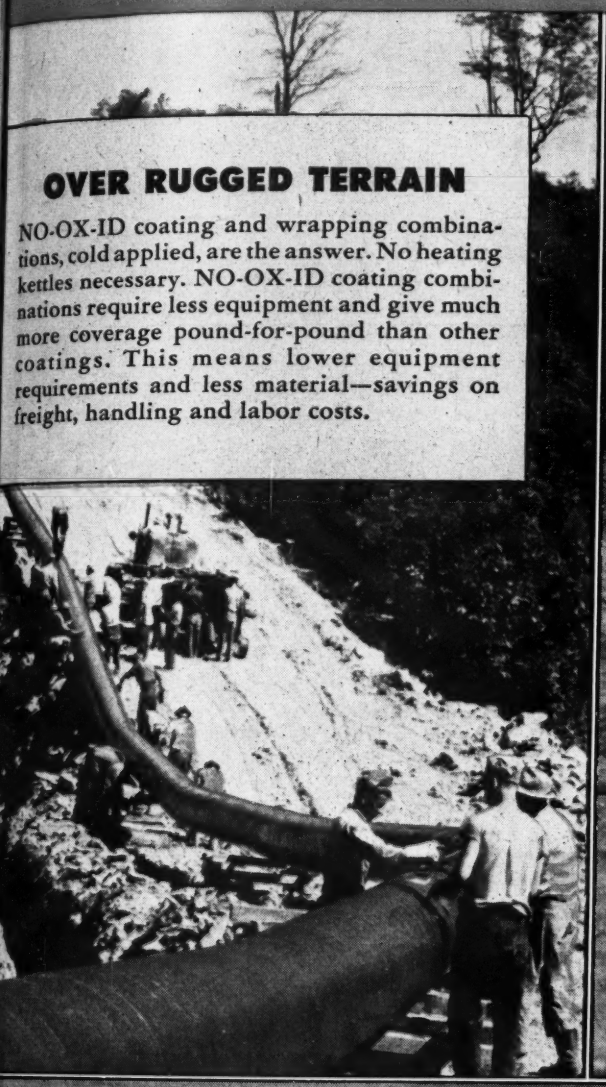

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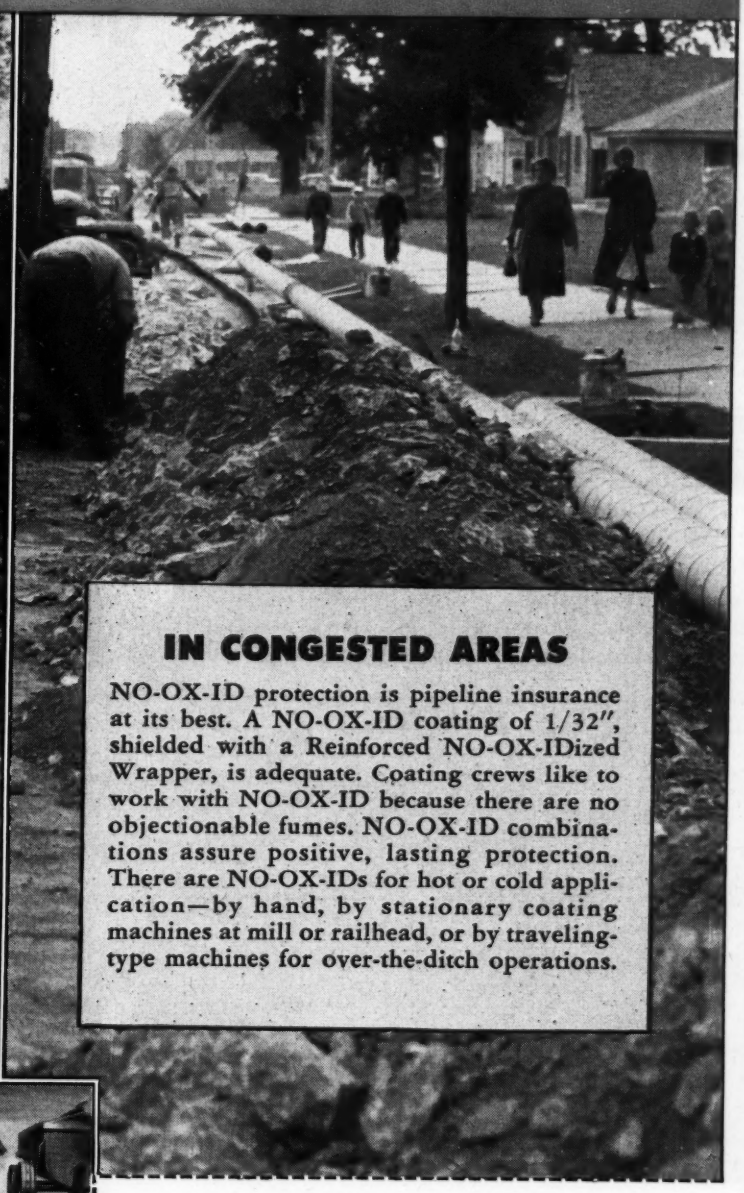

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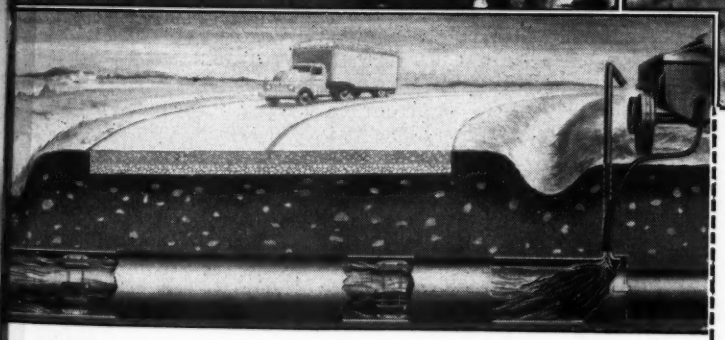

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"Panic gate release" gives quick escape in emergencies

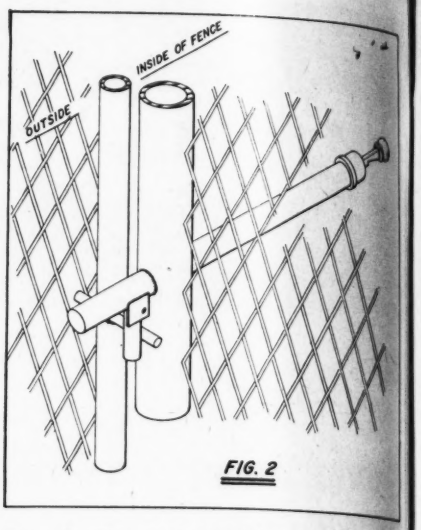


Fig. 2. Drawing showing installation of panic gate release on gate post.

A PANIC gate release, designed to provide a quick and easy means of escape from an enclosure in the event of an explosion or fire, has been patented by Panhandle Eastern Pipe Line Co.

The inventor of the device is Oscar M. Sievert, senior measuring and regulator station operator at the Detroit measuring station. For his idea Mr. Sievert was awarded a top prize of $50 in the company's Operating Kinks judging.

Component parts of the release include a barrel, made up of 1-in. pipe, a sliding bolt, lock pin, compression spring and a pipe cap *(Fig. 1)*.

The release is mounted on a fence gate post with the "trigger" end of the device extending inward. Pushing forward on the ball end of the release moves the sliding bolt forward, releasing the lock pin and allowing it to swing outward at a 90° angle. This in turn releases the gate, letting it swing open. A ½-in. steel rod welded to the gate serves as a latch bar which keeps the gate closed when the release is locked *(see Fig. 2)*.

The device is so constructed that the ball end of the release projects a sufficient distance within the enclosure. This prevents the gate release from being operated by anybody on the outside of the fence *(Fig. 2)*.

The gate release can also be permanently locked if at anytime the enclosure is to be left unattended for a length of time. The padlock is inserted in a drilled hole near the base of the sliding bolt.

The gate release can be built by welders out of pipe and bolts, according to Mr. Sievert. Its sturdy construction assures a long operating life for the device.

The panic gate release serves a dual purpose; it not only provides an efficient way for speedy escape from an enclosure, but also prevents entry from outside, thus eliminating the need for constant patrolling of an enclosure.

The possibility that employees manning a company installation might be unable to escape from the grounds in the event of a fire or explosion lent special emphasis to the Operating Kinks committee's consideration of Mr. Sievert's invention. Isolated cases in the past where employees in the natural gas, and associated industries, suffered death or injury because of the absence of a suitable means of escape emphasized the need for such a safety device.

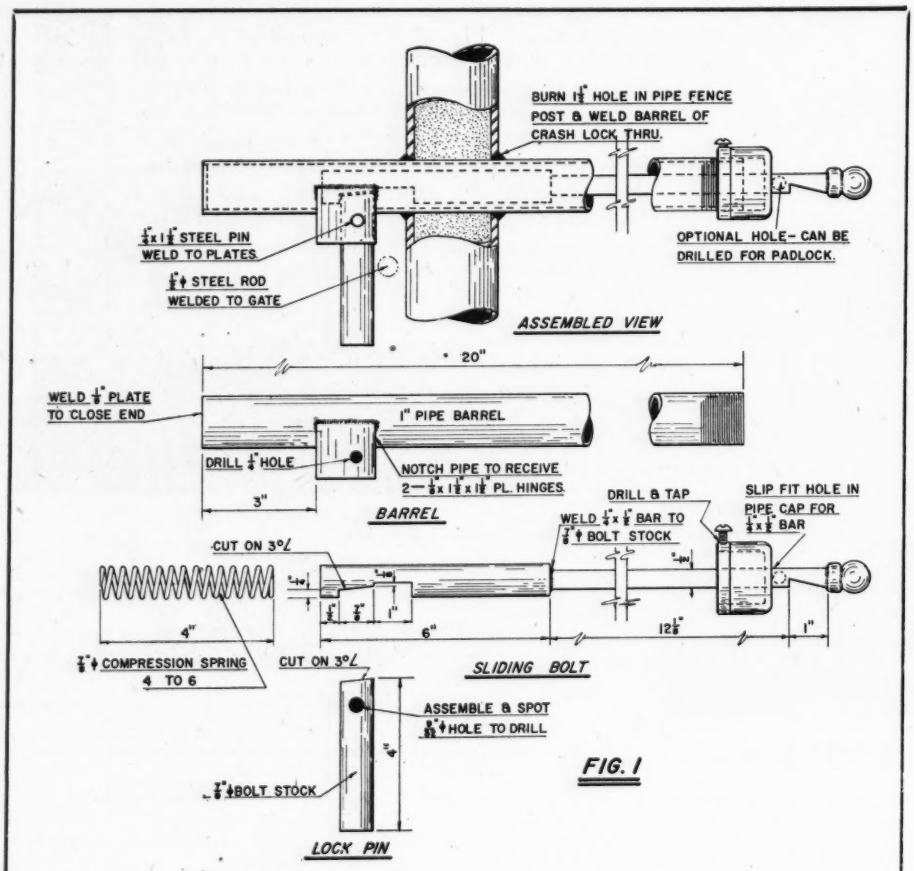
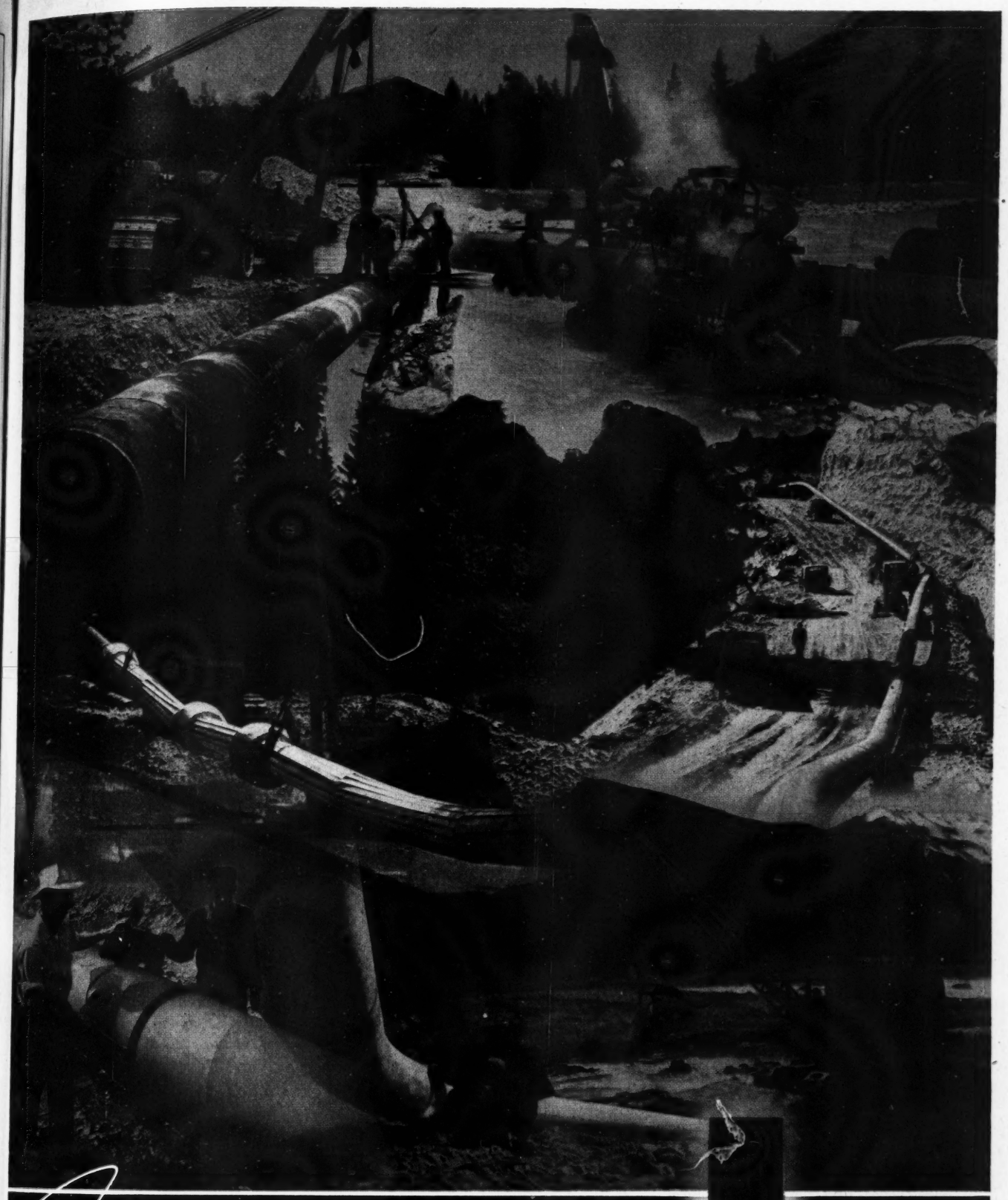

BURN 1¼" HOLE IN PIPE FENCE POST & WELD BARREL OF CRASH LOCK THRU.
¼"x1½" STEEL PIN WELD TO PLATES
½" STEEL ROD WELDED TO GATE
OPTIONAL HOLE - CAN BE DRILLED FOR PADLOCK.
ASSEMBLED VIEW
20"
WELD ¼" PLATE TO CLOSE END
1" PIPE BARREL
DRILL ¼" HOLE
NOTCH PIPE TO RECEIVE 2—⅜"x1½"x1½" PL. HINGES
3"
BARREL
DRILL & TAP
WELD ¼"x¼" BAR TO ⅜" BOLT STOCK
SLIP FIT HOLE IN PIPE CAP FOR ¼"x½" BAR
CUT ON 30°
4"
6"
12½"
1"
⅜" COMPRESSION SPRING 4 TO 6
CUT ON 30°
SLIDING BOLT
ASSEMBLE & SPOT ⅜" HOLE TO DRILL
FIG. 1
⅜" BOLT STOCK
LOCK PIN

Fig. 1. Sketch for assembling panic gate release.

Story and photos courtesy of *Panhandle Lines*, published by Panhandle Eastern Pipe Line Co.



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Not initial outlay, but "wages paid" is proper way to charge tool costs

By WILLIAM M. HENDERSON

WAGES to be sustained must be offset by production. Otherwise the cost to manufacture will price the producer out of the market and the worker out of a job.

Tools make workmen productive. Increased production reduces manufactured costs, retains the market and consequently the worker retains his job.

Here then, is an economic approach to put the worker and the work in balance.

Mr. Henderson formerly was superintendent of distribution for Southern California Gas Co., Los Angeles.

We think of workers in terms of the wage paid per minute or per hour. But, when we consider tools, we look at the price tag —the first cost.

Since tools supplement men, then the man or the tool, without the other, is but the bare bones of a possibility.

Put tools in workers' hands and the enterprise is animated—the equation is in balance and the answer is production.

The solution is simple if we think in terms of the common denominator—wages. Wages for tools, same as we think of wages paid men.

What constitutes tool wages

The wage for tools is the sum of the charges paid for the use of the money to purchase the tool; that is, interest on the investment, plus a depreciation charge to amortize the cost within the useful life of the tool.

To illustrate—consider a $100 investment in a tool. The wage for the use of the $100 at 6% per annum paid monthly is 50 cents; assume about four years for retirement of tools or 24% per annum on the cost of tool, that is $2 monthly charge. So then the total fixed charge to possess the tool and retire it at four-year intervals is $2.50 a month.

On a work month of 21 eight-hour days (168 hours), the $100 tool wage is 1½ cents a work hour. That is less than the wage rate paid for but one minute of one worker's time.

All that need be expected from that tool is to recover as productive work the equivalent of one-man minute of every hour on the job. Then the tool pays its wage, and any additional production recovered is clear profit.

Cost: 15 cents per hour

On the same basis, $1000 invested in tools, costs but 15 cents an hour, or $10,000 costs only $1.50 an hour on the job.

Here is a fact: the worker sells time and makes it available for use. If you fail to use the time efficiently, or not at all, you pay. Time paid for but not used is a total loss.

Whereas, when you purchase tools the cost is not the purchase price, but only the carrying charge. When the tool is idle, this charge is not a total loss, like unused labor time, for you still have the tool.

For the lack of tools time is lost. Obsolete and worn tools lower production. Tools should be available in good order and modern—better to have extra tools than idle men—for tools contribute to increased production, better quality of work and the recovery of unproductive time on the job.

It is all very simple.

Put the tool on the payroll, you get immediate use, the tool earns its keep and helps pay the worker's wage.

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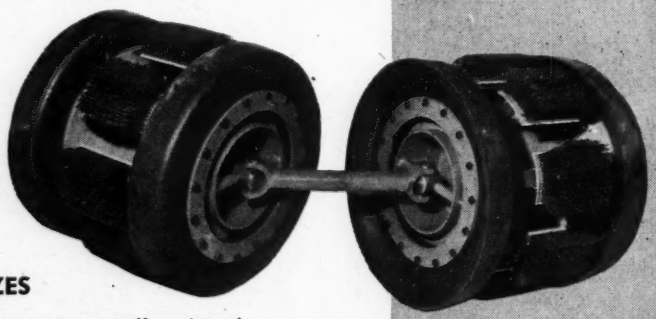

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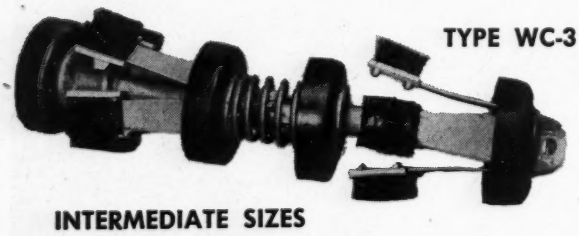

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CEC inaugurates analysis service

Provision for handling the chemical analyses of gaseous mixtures on a per-analysis basis has been set up by Consolidated Engineering Corp. of Pasadena, Calif., with the establishment of a fully equipped laboratory and trained staff as the Consolidated Analytical Service Department.

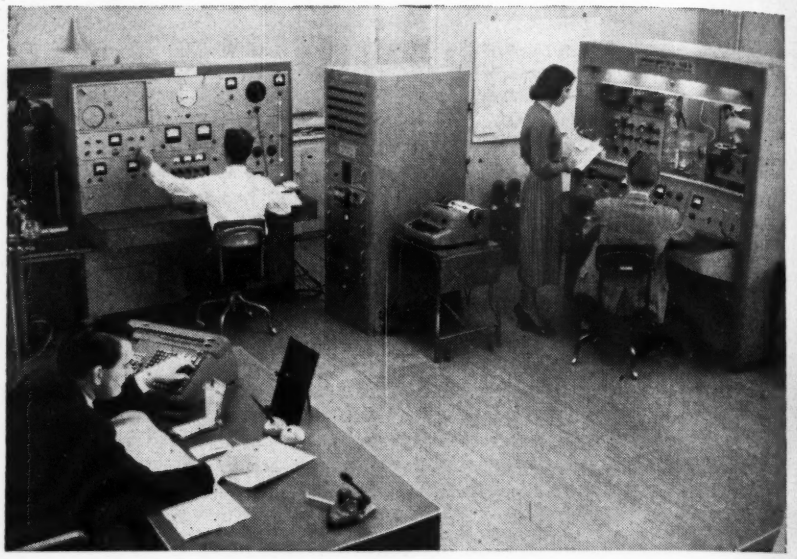
The service is based upon the occasional need for the use of mass spectrometer type instruments by industry for handling specialized problems in chemical analysis where they occur too infrequently to justify purchase.

Among the instruments available through the department are the 21-103B and 21-401 mass spectrometers, the 24-101A leak detector, the Spectro-SADIC, and the 30-103 electric computer. Pure samples submitted for isotope assay are measured on the 21-401 mass spectrometer, while the 21-103B is used for the chemical analysis of gaseous and light liquid mixtures. A model 30-103 electric computer is available for the rapid solution of simultaneous equations such as those resulting from mass spectrometer or infrared applications.

As a general rule, precise analyses can be made on organic and inorganic gas or light mixtures for as many as 20 unknown substances having molecular weights up to 300. In addition, trace and purity determinations for as little as .001 mol percent can be made.

Typical of the test programs conducted by the analytical service is the periodic gas allocation analysis for the SACROC Unitized well in Scurry, Texas. Samples taken simultaneously from as many as 360 different locations in the SACROC field are precisely analyzed for methane, ethane, propane, and natural gasolines to determine how profits should be divided among the individual well owners in the cooperative enterprise.

Sample requirements for both the analytical and isotope-ratio mass spectrometers are unusually small, recommended quantities being 100 cc for gas and 5 cc for liquids, though much smaller amounts have been handled. Containers ranging from 1 mm diameter tubes a few inches long and having sample pressures in the micron range to large high-pressure steel bombs, can be handled.



Corner of the Consolidated Analytical Service Department laboratory with some of the specialized equipment now available to industry on a per-analysis basis. The analytical mass spectrometer 21-103B, used for the chemical analysis of gaseous and light liquid mixtures, is in the left background. In center background is the Sprecto-Sadic, which is used for high speed digital tabulation, and beside it is the IBM electric typewriter readout. Operators at right are working with the isotope-ratio mass spectrometer. Engineer in the foreground is reducing data from a mass spectrometer photo record.

Pipeline News

FPC decision confuses Canadian situation

Canadian gas producers, royalty owners, consumers, and the government of Alberta last month found themselves in a bewildering dilemma which was the natural culmination of the provincial and dominion governments' astounding inability to make up their collective minds.

And the only apparent solution to the situation was to make a hasty decision.

The fly in the ointment, which officials in Ottawa and Calgary were desperately trying to spoon out in mid-month, was the FPC's approval on Sept. 1 of the joint plan of Tennessee Gas Transmission Co. and Niagara Gas Transmission Ltd. to export U. S. gas for use in the Toronto market.

Not only did this action remove a substantial market from the proposed service area of an all-Canadian pipeline to the eastern provinces, but, oddly enough, it also had a strong bearing on the Northwest gas situation, with Northwest Natural Gas Co.'s plan for export of southern Alberta gas, which had been considered a dead duck, being given a strong chance of revival. Even Northern Natural Gas Co., Omaha, was affected.

The hasty decision, a move to block Consumers Gas Co., the Toronto distributor, from actually taking any gas from Tennessee via Niagara, consisted of Alberta's awarding of an export license to Trans-Canada Pipe Lines Ltd. for an all-Canadian line despite the fact that the three-way battle for the permit was apparently still some hearings away from a decision.

The next move was up to the Ottawa government, which was reportedly seeking a politically popular way to bar U. S. gas from crossing the border.

The FPC decision caught Canadian officialdom and the press completely off guard. Hearings had been progressing in Calgary, involving Western Pipe Lines, whose plan envisioned a swing into Minnesota, where it would sell 170 MMcf to Northern Natural, before continuing on eastward through Canada; Mid-Continent (considered a dark horse), which would also drop gas off in the U. S. en route; and Trans-Canada. Some cause for optimism over the chances of Western picking up the marbles was seen in the Alberta government's expressed desire to sell to the highest bidder, and the Western scheme was said to be the most economical of the three. But the dominion government was holding out for the all-Canadian line, even if subsidy were necessary to make it pay, in line with its expressed wish that the "Canada first" policy be served.

The *Toronto Post,* just three days before FPC made its move, had expressed doubts that FPC would act favorably toward Niagara. Premier Frost's expression of opposition to import "in small quantities" was transmitted to FPC, although it arrived too late to affect the decision.

The certification of the Niagara-Tennessee plan was hailed openly by Westcoast and Northwest Natural, who deserted their own hearings to obtain copies of the decision. Each saw it as a rebuttal to the anti-Canadian argument that Northwest gas companies would become "economic vassals" of Canada if Alberta gas were to be imported since the dependence of one country on the other

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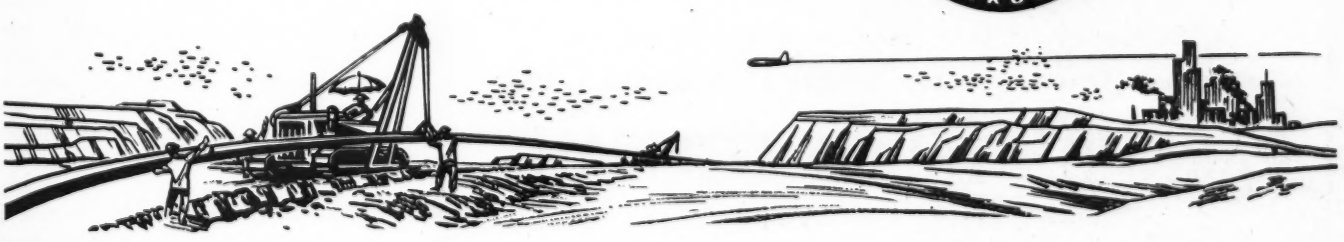

would be mutual. Northwest Natural, which holds no export license, saw renewed possibilities of a change of heart by the Alberta government since its gas sources in southern Alberta might not have to be dedicated to the use of an eastern line.

Oddly, however, the dominion government began envisioning its own country in the position of a "vassal" (although that term was not use) if Niagara's plan should be consummated.

The FPC's Sept. 1 decision also included permission for Tennessee to transport a maximum of slightly over 49.7 cu ft of gas per day, purchased in the southwest by Iroquois Gas Corp., Buffalo, for delivery to that company in Pennsylvania and New York.

The decision met with strong opposition from veteran Commissioner Nelson Lee Smith, who denied that the plans met the statutory tests of being required by public convenience and necessity.

No assurance

"While, as the majority points out," he said, "there is no assurance that the particular gas (though not Tennessee's system capacity) to be transported for Consumers and Iroquois would otherwise be available to Tennessee and its customers, it nevertheless follows that, if its exportation were precluded, that gas would of necessity be subject to utilization within the United States . . ."

He also pointed out that the Canadian authorities have not made any official representations on the record for or against the project. "To that extent this may be due to the pendency of the Trans-Canada proposal to carry gas from the western to the eastern provinces, which is admittedly beyond our jurisdiction, can be only a matter of conjecture," he continued. However, pointing to contentions that the Tennessee exportation may render Trans-Canada's project infeasible, Commissioner Smith asserted that "under these circumstances it seems to me that we should defer action on the export pending official action by Canada on the subject, which this record shows is now before its responsible officials."

Noting that all of Panhandle Eastern Pipe Line Co.'s exports authorized by the FPC have been conditioned to make them subject to complete interruption at any time when the needs of its American markets so require, he said that a similar condition here has apparently been made impracticable because of the arrangement whereby the gas to be exported (for Niagara), like that to be transported for Iroquois, is not the property of Tennessee. (Gas will be purchased by Niagara and Iroquois in the producing areas.)

Turning to the transportation of gas by Tennessee for Iroquois, Commissioner Smith said, that company will pay $1,361,278 more per year, or 7.6 cents per Mcf more, under this arrangement than it would if it purchased the gas directly from Tennessee. "Just why the commission should permit Iroquois and those whom it serves to be penalized by this amount . . . is by no means clear to me," he stated. "Since Tennessee admittedly now has both the capacity and the gas with which to render the desired increased service to Iroquois," he continued, "it seems to me that the public interest calls for our requiring it to be furnished."

Dangers may arise

Finally, Commissioner Smith said, attention should be called to certain dangers which may arise in connection with arrangements for the transportation of gas for hire. Among other things, he cited the potential harm to the public interest generally if there were "any considerable migration of desperate gas distributors into the gas-producing fields in an effort to acquire and preempt reserves which they need to serve their customers but are unable to secure through their ordinary pipeline sources of supply."

He said that the "impacts of such purchases and prices—through their activation of certain types of 'favored-nation clauses' —upon segments of the public far removed from any direct connection with the natural-gas systems and supplies immediately concerned is something to which I think the

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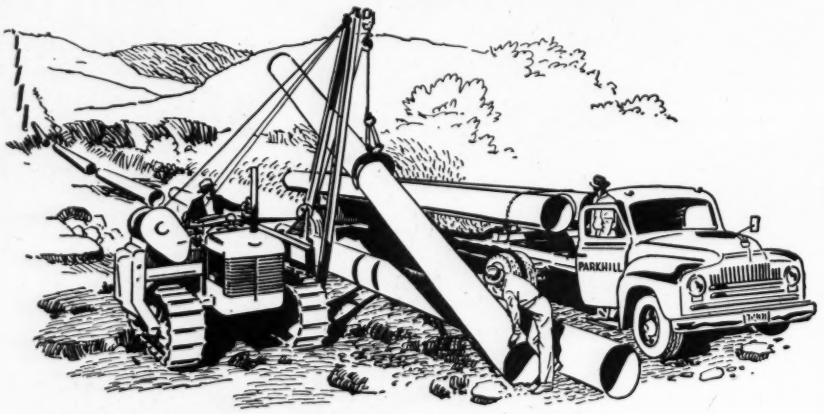

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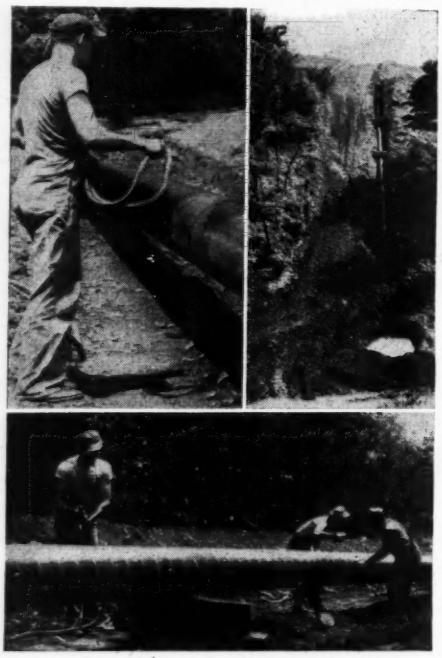

Upper Right—An Equitable Gas System 20″ line through rough country. Upper Left—First coat of Roskote being sprayed on this line in the field, no primers needed. Bottom—The pipe is then wrapped with Royston Glas-Wrap and given a second coat of Roskote.

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commission should soon give searching consideration."

Under the authorization, Tennessee will increase its pipeline system capacity to transport up to 22.6 billion cu ft of gas annually from the Gulf Coast area for delivery to Niagara at the U. S.-Canadian boundary near Niagara Falls.

Niagara will purchase 61.914 MMcf per day in the producing areas and Tennessee will transport this amount for delivery at the border. When Niagara's daily requirements drop below this amount, the difference will be stored by Tennessee for later delivery. Niagara will transport the gas for delivery to Consumers Gas Co., Toronto, through a line which Consumers Gas proposes to construct from Toronto to the border. (Niagara is owned by Tennessee and Consumers.)

Facilities approved

Facilities to be constructed include 904 miles of pipeline and 38,800 hp in compressor capacity, at a cost of $91,718,000.

The project will consist of 571 miles of 30-in. mainline from a station near Kinder, La. to Tennessee's station near Portland, Tenn.; 67 miles of 30-in. loop line in Texas and Louisiana; 63 miles of 26-in. loop in Ohio and Pennsylvania; 45 miles of 20-in. line from Buffalo to the U. S.-Canadian border; 58 miles of 20-in. line in Louisiana from its present system on the Gulf Coast to the Kinder station; 100 miles of miscellaneous laterals in Texas. Of the additional compressor capacity, 17,520 hp will be installed at existing stations and 21,280 hp in three new stations in Mississippi, Kentucky and New York.

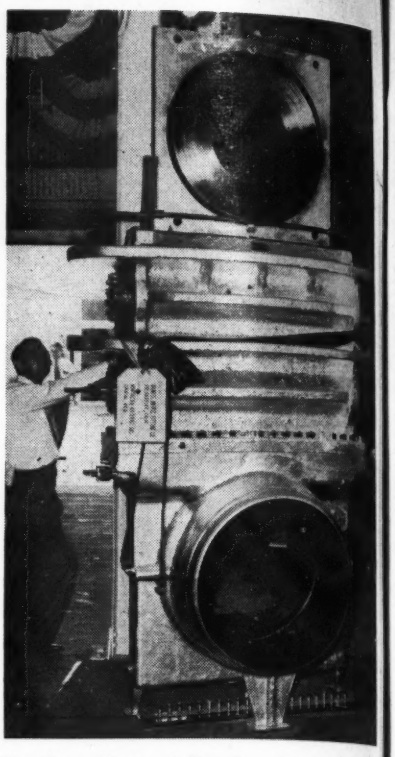
In the Northwest hearings, testimony was pretty much confined to rates, service areas and reserves estimates, with both Westcoast and Pacific Northwest showing substantial increases in estimated reserves. Westcoast claims to have purchased commitments or letters of intent covering more than 3.5 trillion cu ft while Pacific Northwest claims a 3.6-trillion-cu ft reserve available for its proposed project.

Laclede requests right to condemn area for storage

The Laclede Gas Co. of St. Louis has asked state permission to go ahead with its plans for underground storage of gas in the Florissant area of St. Louis and St. Charles counties. It filed a formal application with the public service commission asking it to find that it would be in the public interest for the company to condemn underground storage space if this measure became necessary.

The application was filed under a new law which went into effect late in August, requiring the company to seek to negotiate contracts with property owners. If PSC permission is granted, it could also resort to condemnation if negotiation failed.

The area outlined for the proposed storage covers about 6000 acres. The company said



Northern Natural Gas Co., Omaha, is installing this 9000-lb, 30-in. orifice fitting for use as a check meter on the inlet side of the Mullinville, Kan., compressor station. Said to be only the third flange of its size in use in this country, the fitting cost Northern $8250.

test drilling has shown that the St. Peter sandstone, to be used for storage, contains no valuable minerals or potable water. Laclede also assured customers in the area that the proposed storage would not interfere with any future oil development in the strata above the reservoir where signs of oil have been found.

Gas seepage at Herscher traced to leaking well

Gas seepage that brought a halt to development of the huge underground storage area, Herscher dome, near Kankakee, Ill. (see page 27, September *GAS*) has been traced to a leak in one of the project's 21 injection wells. The dome is being developed by Natural Gas Storage Co. of Illinois, a subsidiary of Peoples Gas Light & Coke Co., Chicago.

The company had not been sure the gas bubbling up in the Herscher area was its own, as it started out several weeks ago as 94% nitrogen gas. Its character changed as much more methane appeared and finally indications of ethane. The company believes the escaping reservoir gas pushed water, which in turn, pushed the marsh gas up ahead of it.

The soundness of the dome was rechecked by a review of geological and engineering studies for the project and additional drilling. The engineers were convinced the storage area is tight. This led them to check

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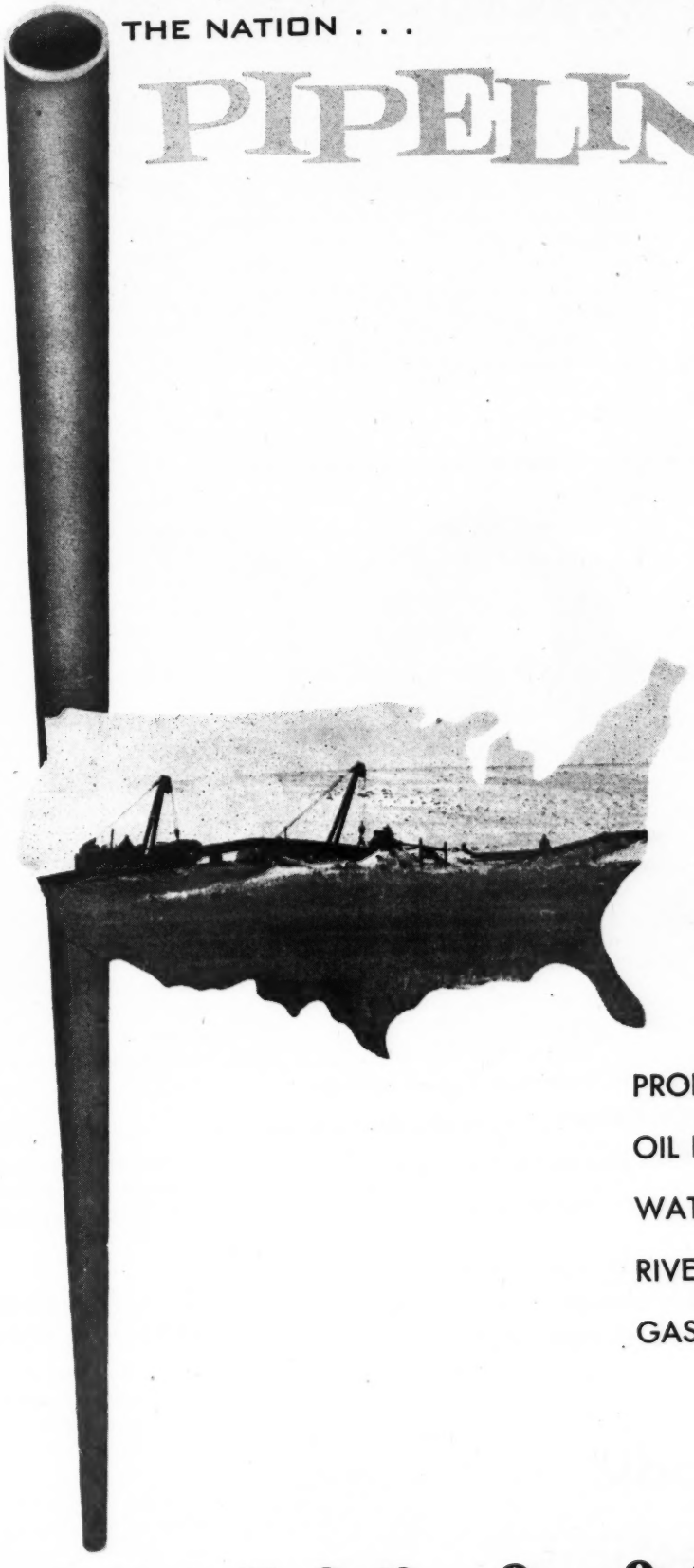

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the various injection wells.

The leak was discovered in Karcher No. 1 well with a neutron logger which was lowered into the well to 1100 ft where it detected the leak. The reservoir is about 1800 ft below ground. The well has been plugged off and the casing perforated to check the amount of gas built up in the sand at that level and to drain it back out.

Reversal of decision in Phillips case sought

Texas has joined Oklahoma and New Mexico in urging the U. S. Supreme Court to overrule a decision of the Court of Appeals for the District of Columbia that the Phillips Petroleum Co. is "a natural gas company" and therefore is subject to regulation by the Federal Power Commission.

Texas Atty. Gen. John Ben Shepperd filed a brief late in August as an intervenor with Phillips in which he said all of Phillip's gas operations are carried on in the producing fields. More than 2300 other independent producers or gatherers who sell gas to natural gas companies will be affected by the decision in the Phillips case. Extension of the FPC authority would be an "intrusion of federal regulation in a field of activity hitherto reserved to the states," he noted.

Mr. Shepperd also said the decision of the Supreme Court may have an important bearing on the final decision of the Texas natural gas pipeline tax case now on appeal in the same court.

Final obstacle removed; gas flows to New England

Federal Judge Alfred E. Modarelli late in August lifted a temporary order restraining the Algonquin Gas Transmission Co. from delivering gas to Boston, thereby removing the final obstacle to the company's proposed service. Algonquin was granted final certificate to serve the New England area Aug. 6 after many months of court battles and FPC hearings. Work on several laterals is expected to be complete and the entire line in operation by mid-October.

The original restraining order was obtained by two New Jersey realty companies, Ramapo Park Inc. and Rockledge Inc., both headed by Clifford McEvoy. Mr. McEvoy, in a $450,000 damage suit, charged that grading operations had not been completed where the 249-mile line passed through his properties in Bergen and Passaic counties, N. J. Denial of extension of the order was based on the assurance that necessary ground work for grading could be done safely with the line in operation.

The gas company proposed to engage a blasting expert, suitable to both parties, to supervise the operation. Gas will be removed from the section of line and in some cases the pipe removed where it is necessary to blast rocky ground. The company said this could be done without interruption of service by packing sufficient gas for 24 hours into the section of pipe on the Boston side before it is shut off. A series of 24-hour interruptions would allow completion of the work.

The judge noted that Algonquin intended to pump $44,000 worth of gas a day through the line and if the restraint were continued it would mean a "staggering sum" to indemnify Algonquin in case it should prevail in a civil suit.

Operation begins at new Lone Star gasoline plant

Lone Star Gas Co.'s new gasoline plant at Springtown, Texas, about 30 miles northwest of Fort Worth, began operation the first of September.

Constructed at a cost of $600,000, the plant has initial capacity for processing 45 MMcf of gas daily and will recover 35,000 gals. of natural gasoline, butane, propane and isopentane daily.

Designed for expansion, the plant can be enlarged to a capacity of 90 MMcf of gas daily.

It is located on an existing 12-in. transmission line and a new 20-in., 35-mile loop line originating near Jacksboro, Texas.

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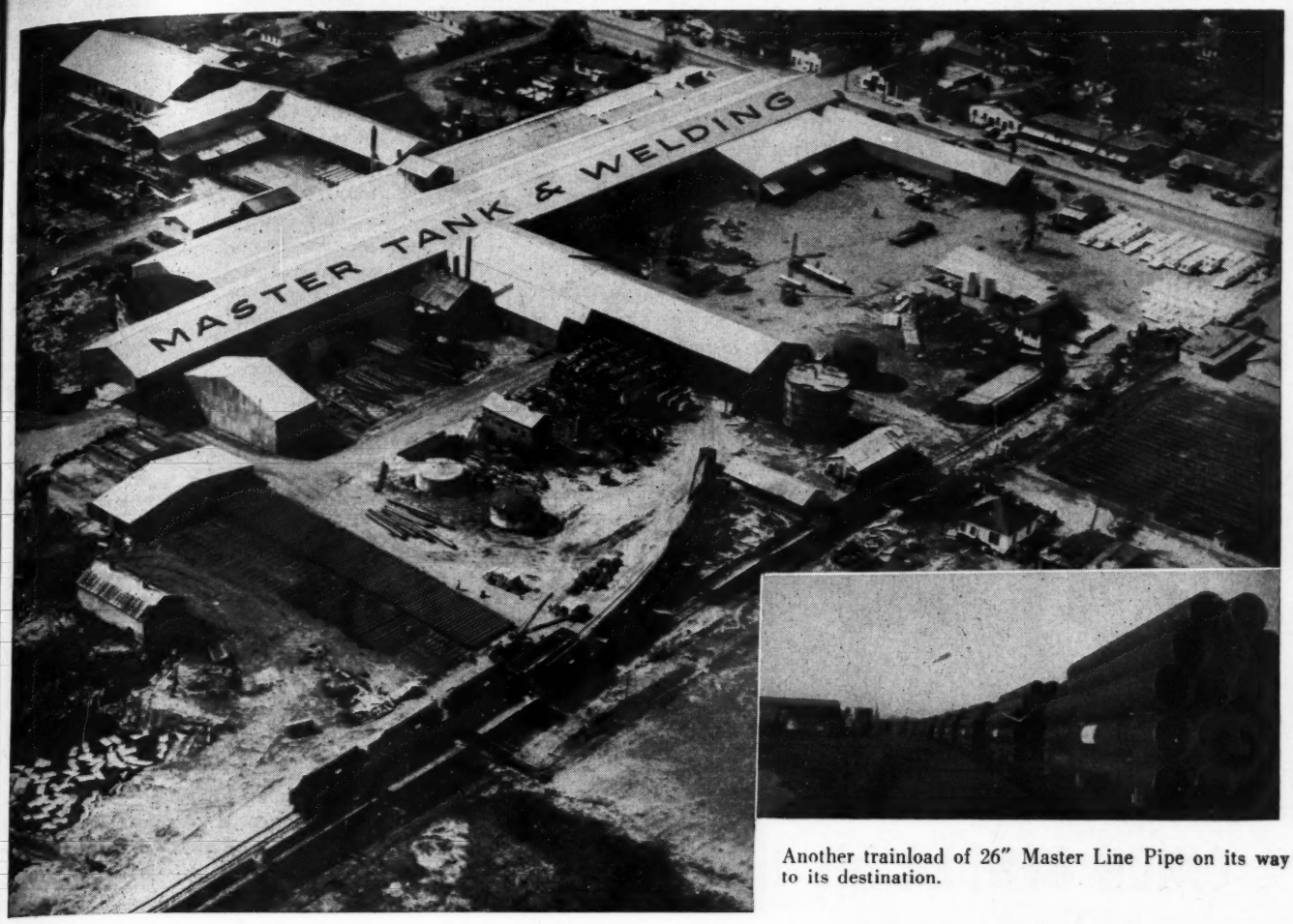

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MASTER GAS SYSTEM — MFG. BY MASTER TANK & WELDING

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at the gasoline plant.

The Springtown plant and 20-in. line are part of Lone Star's $4 million expansion program concentrated in a 100-mile radius northwest of Forth Worth and Dallas and planned primarily to strengthen the gas supply for the greater Fort Worth-Dallas area.

One utility granted rate increase; six firms apply

On the rate scene the past month one utility was granted state approval for a 7½% rate increase and two large suppliers and four of their major customers have filed applications with FPC for wholesale rate increases.

Approved was Alabama Gas Corp's $1,550,000 annual increase which was effected in the bills of the Birmingham firm Sept. 17. The increase was necessary, the company said, because of increase in cost of gas from its supplier, Southern Natural Gas Co.

Declaring its rates would still be lowest in the nation, Colorado Interstate Gas Co., Colorado Springs, filed a proposed $6,508,000 increase, or 34% annually, followed by Colorado-Wyoming Gas Co. of Denver, requesting a 19% raise totaling $473,000 yearly. Interstate's increase would mean about a 23% raise in the price of gas it supplies to customers in Colorado and southern Wyoming. If the increase is approved, Public Service Co., Denver, is expected to request a raise in rates also.

Tennessee Gas Transmission Co., Houston, filed for a wholesale gas rate increase of $6.5 million, about 5% per year. The increase if approved will affect 40 wholesale customers in 9 states. In concurrent applications, three of Tennessee's utility customers also requested increases. They are: Alabama-Tennessee Natural Gas Co., Florence, a 13% annual increase amounting to $120,200; Lake Shore Pipe Line Co., Ashtabula, Ohio, a 5.6% increase totaling $86,000 yearly; and Tennessee Natural Gas Lines Inc., Nashville, an 11% annual raise totaling $227,000.

Oklahoma Natural granted permit for storage area

Oklahoma Natural Gas Co., Oklahoma City, has been granted a permit by the state corporation commission to convert the nearly depleted Sayre Gas Field of Beckham county to natural gas storage. The field covers 864 acres. Plugging and reconditioning of wells in the field has started. The company expects to start injecting 20 MMcf of residue and casinghead gas into the reservoir in the next two or three months.

Engineers estimate that the field, which was discovered in July 1922, is now 97% depleted. It has produced more than 86 billion cu ft of gas which has been distributed to consumers in Oklahoma. Low pressure in the pool makes further operation uneconomical.

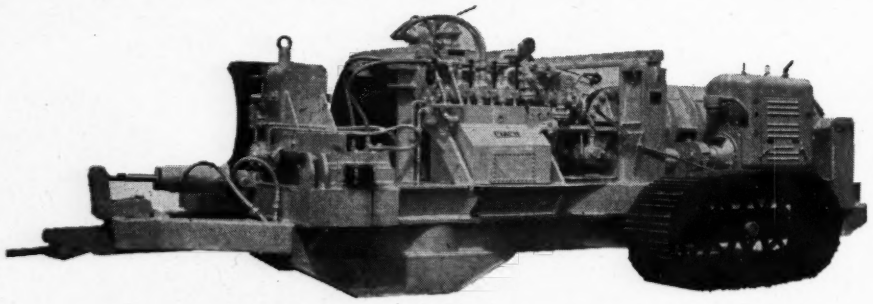
Oklahoma Natural has three other underground storage areas in Oklahoma at Depew, Haskell, and Osage.

FPC accepts Algonquin's tariff for filing

FPC last month accepted for filing a natural gas tariff submitted by Algonquin Gas Transmission Co., Boston, covering service to utility customers in New England. The tariff was submitted in compliance with a condition in the commission's order, issued Aug. 6, which authorized the company to complete its pipeline system and begin natural gas service. The new tariff is to be effective as of Sept. 1.

The company has indicated that the rates and charges reflected in the tariff are to hold for the future, barring unforeseen circumstances. The tariff provides for rates which are about 10% higher than those proposed during the hearings on its certificate application. In support of the higher rate, Algonquin cited changed conditions since the hearings on its application.

Company representatives have emphasized that the tariff was designed to absorb increased cost of gas purchased from its supplier, Texas Eastern Transmission Corp.



CINCH BENDER hit the pipe line industry in 1948

Pioneering the FIRST big inch SMOOTH BENDS—Permitting cleaning and priming, doping and wrapping all in one continuous operation—FOR A SPEEDIER PIPELAYING OPERATION

Here's why the Cinch Hydraulic Pipe Bender gives the owner the pipe line he desires—gives the contractor better production methods— Numerous pipe line contractors who now use Cinch Pipe Benders have found that Cinch assures them speedy, economical, safe pipe bending—pipe that is bent smooth—right on the job. Though many methods have been tried in pipe bending, no better way has been found than the cold compression bending under hydraulic pressure—originated by the manufacturers of Cinch Pipe Benders. The powerful Cinch Heavy Duty Pipe Bender processes pipe up to 30" diameter with ½" wall thickness—yield strength to 50,000 PSI—without weakening the pipe. Numerous engineering tests proved conclusively that the bend—when made with a Cinch Bender—is the strongest point in the pipe line.

ADDED FEATURES OF THE NEW MACHINES:

FOR GREATER SPEED—Automatic hydraulic wedge-type pin-up slide, larger piston rams with larger return oil lines, hydraulic lift tongue and hydraulic powered Tulsa winch.

FOR EASIER HANDLING—All controls in reach of the operator. Athey Tracks are optional.

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under the rate it has moved to put into effect under bond as of Sept. 1. They stated that no increase in rates will be made by Algonquin on that account, even though it may amount to as much as 2.2 cents per Mcf and $500,000 a year, based on Algonquin's first year of operations. At 74% load factor, the tariff results in an average rate of about 52.6 cents per Mcf compared with 47.9 cents as previously proposed.

Service begun to consumers on Saskatchewan system

Saskatchewan's first major natural gas system—101 miles of line and distribution systems in Saskatoon and four other municipalities—is almost complete. Gas was expected to flow to some of the 700 expected consumers before the official opening date of Oct. 1. Nearly 6000 consumers have been signed up.

The system, which will cost over $7 million, is owned by the government, and is believed to be the first line "of major proportions built simultaneously with the distribution systems it is to serve," said J. W. Tomlinson, general manager of the Saskatchewan Power Corp.

Equitable storage project in West Virginia approved

FPC has authorized the Equitable Gas Co., Pittsburgh, to operate a natural gas storage field in Wetzel and Marion counties, W. Va. The company plans to activate the Logansport pool by construction of a 1320-hp compressor station, 9 miles of 12-in. pipeline and about 1.8 miles of 6-in. and 0.7 miles of 8-in. well connecting lines.

The project also includes reconditioning of nine existing wells. Of the 25 wells now located in the pool, 21 will be operated initially with the remaining four added after testing.

The facilities are expected to provide storage capacity of 3023 MMcf of gas with a maximum daily deliverability from the area of approximately 59.5 MMcf. Total estimated cost of the storage project is $2,217,400.

AIEE to hear reports on power systems, microwave

The American Institute of Electrical Engineers' will have its fall general meeting at hotel Muehlebach, Kansas City, Mo., Nov. 2-6. Eight technical papers, presented by specialists in the field of electrical engineering, will be heard at three sessions.

Among them C. D. Catt, El Paso Natural Gas Co. and J. K. Howell, Westinghouse Electric Corp. will deliver a paper on "Natural Gas Plant Power Distribution Systems." Also scheduled is a report by E. B. Dunn, Keystone Pipe Line Co., on "Petroleum Microwave Progress 1950-53."

PROOF

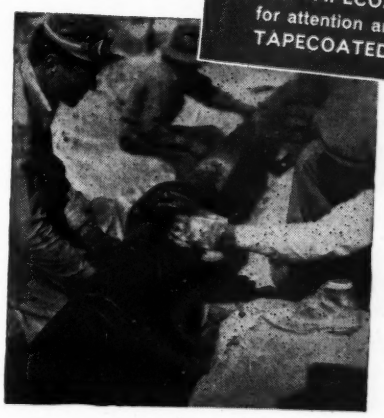
HERE'S HOW TAPECOAT® HAS STOOD THE TEST OF TIME TO SOLVE CORROSION PROBLEMS

PROOF (Underground) — Inspection of TAPECOATED joints after 10 years of underground service showed no sign of corrosion when the TAPECOAT was removed.

PROOF (Alternate wetting and drying) — Expense and trouble in protecting lines subject to wet and dry conditions at cooling towers have been eliminated since 1944 by coating with TAPECOAT.

PROOF (Underwater)—During the re-laying of an underwater pipe line in the Gulf area, examination showed that TAPECOAT had protected the pipe against salt water corrosion and barnacles.

PROOF (Above ground)—A gas line at a bridge crossing was TAPECOAT-protected in 1944. There has been no need for attention and *no interruption of service* since the pipe was TAPECOATED.



Actual experiences like these show what TAPECOAT coal tar protection can do for you.

Use TAPECOAT to combat corrosion above or below ground on gathering lines, transmission lines, meter stations, compressor stations, distribution lines, pipe joints, bolt-type couplings, fittings, large bends, large diameter pipe, insulated lines, tanks, and other surfaces subject to corrosion.

Write for descriptive brochure and prices

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Originators of Coal Tar Tape Protection

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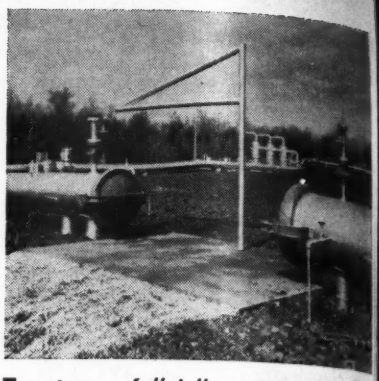
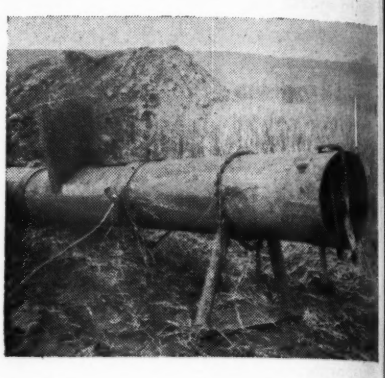
Notes

Tube Turns Inc., Louisville, Ky., manufacturers of welding fittings and flanges, has established a branch plant in Houston to provide special service to the petroleum industry in the southwest. The new plant, under direction of district manager W. B. Whenthoff, is located at 7120 Katy Highway.

Work has begun on a 152-mile natural gas pipeline system which will serve Charleston, Columbia, Summerville, Bamberg, Denmark, Orangeburg, and Walterboro, S. C. Contract for the system, being built for South Carolina Natural Gas Co., has been let to Williams Brothers Co., Tulsa. The line will connect with Southern Natural Gas Co.'s system near Aiken. Natural gas is expected to reach Columbia and Charleston by the end of the year. Charleston is making plans for the changeover from manufactured to natural gas.

Dowell Inc. has announced formation of a new district for its operations in the Rocky Mountain Empire. Emery H. Nielsen, formerly assistant manager at Wichita, will be manager of the district with offices in the Patterson building, Denver. Office manager will be William J. Buehler, who is transferring from the Tulsa office. States included in the new district are Montana, North and South Dakota, Wyoming, Colorado, Utah, and northern New Mexico.



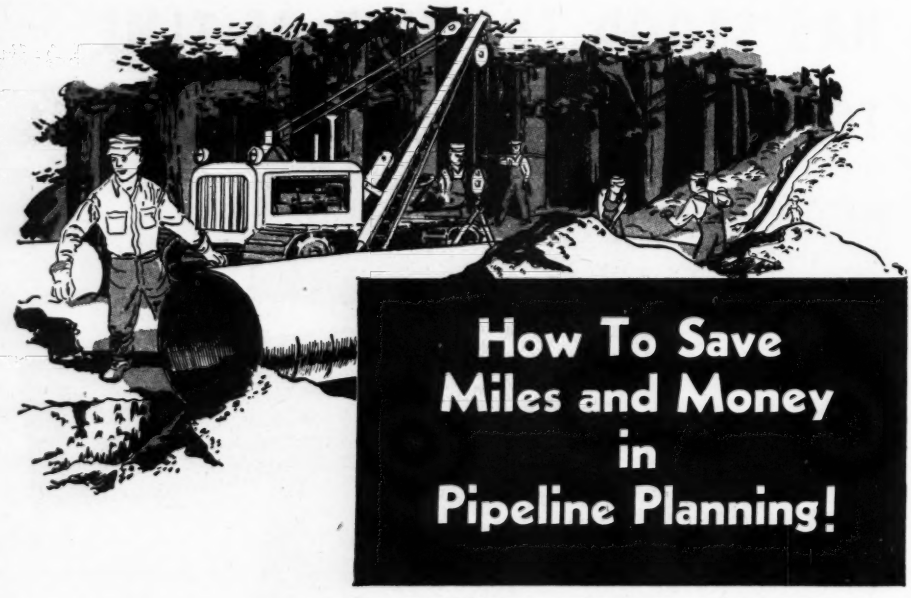


Two types of "pig" catchers are shown here in use on lines of Cities Service Gas Co., Oklahoma City. As part of its system, the company has installed the scraper traps (above) made by Thornhill-Craver Co. Inc. as permanent equipment. Below is a temporary scraper trap cut into a 20-in. line near Wichita.

Northern Indiana Fuel & Light Co., Auburn, has asked the FPC for authority to build a 35-mile pipeline to supply gas to 12 Indiana communities. The line would extend from Panhandle Eastern Pipe Line Co.'s system near Edgerton to Northern Indiana's existing distribution system at Auburn.

An application filed by Pacific Gas & Electric Co., San Francisco, last month asks FPC to approve construction of about 11 miles of pipeline in the Pittsburg, Calif. area. It would consist of 10½ miles of 24-in. line from its Antioch control station to its steam electric plant at Pittsburg, and 2500 ft of 24-in. line to serve as a tie-in with Standard Pacific Gas Line Inc. at Stoneman Junction. The line, designed to deliver 6.5 MMcf of gas per hour to the steam electric plant, will cost about $992,800.

Union Oil Co. of California is developing a "major gas field" in Louisiana south of West White Lake field in Vermillion parish. Efforts of the company had been directed toward oil, rather than gas, but a well currently being drilled has penetrated



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4. You can easily check progress reports and compute speed of stringing for each kind of terrain.
5. You can locate and use trails or easy access routes to the job in wild areas.

Abrams surveys do save miles and money—one client recently reported saving 1½ miles of line in just one 12 mile section—a saving that paid for the entire survey many times over.

Write for complete information and a copy of "Pipeline Planning from the Bird's-Eye View."

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several gas-condensate sands which the company believes will be highly productive and which may develop as the largest gas field in Louisiana.

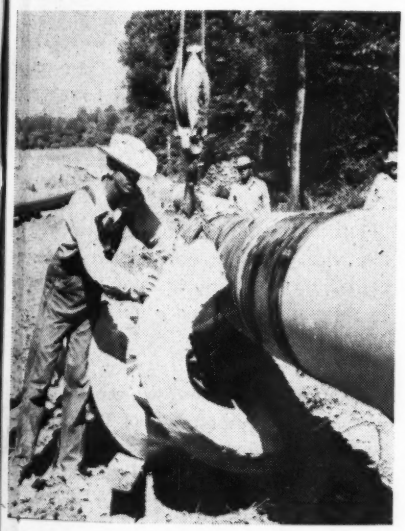
Vaughn & Taylor Construction Co. Inc., pipeline contracting firm, formerly of Wichita Falls, has announced the removal of its general headquarters to Odessa, Texas. The location is 2103 North Grant, mailing address P.O. Box 2624.

Three States Natural Gas Co., Dallas, has completed a gas well, the No. 1 Paul T. Walton, in Emery county, Utah. It is said to be the largest in the state and probably the biggest gas producer in the Rocky Mountain area. It showed an official absolute open flow of 136 MMcf of gas daily from a depth of between 4078 and 4439 ft.

El Paso Natural Gas Co. has tested an exploratory well in Carbon county, Utah. The controlled test showed a flow of 2.3 MMcf per day. The area is 50 miles from the Clear Creek field, also in Carbon county which is being developed as a producing gas field. El Paso has also acquired half interest in the Twin Buttes unit in Douglas Pass area of Garfield county, Colo. The unit has two producing gas wells with a third being drilled.

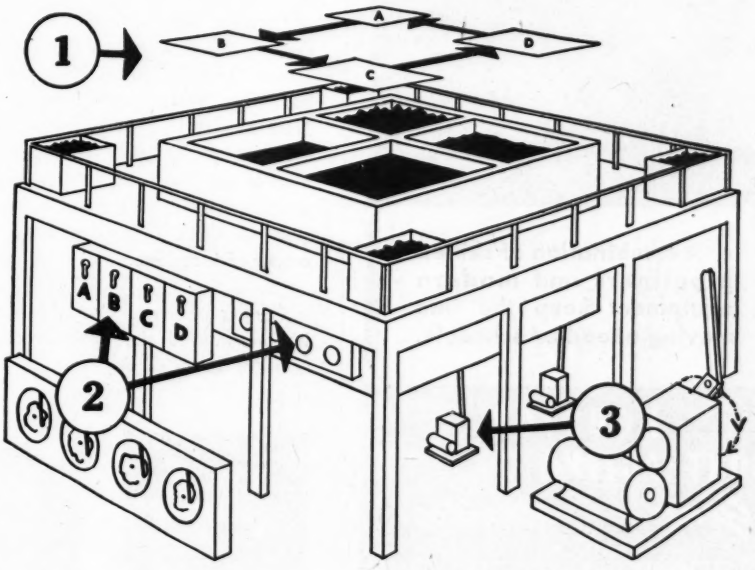
The Arkansas-Western Gas Co., Fayetteville, Ark., has applied to the Arkansas Public Service Commission for authority to spend $171,000 to expand its system. A larger transmission line will be placed in operation between Springdale and Siloam Springs.

Sunray Oil Corp., Tulsa, has announced the formation of a gas sales division within its production department. C. F. McCarroll will be manager of the division. He will be responsible for gas sales contracts and sales of gas produced by Sunray.



Heavy concrete weights are attached to a section of 24-in. pipe to hold it in position at a river crossing on a loop line for Southern Natural Gas Co. as H. C. Price Co. neared completion of its 200.4 miles of the project.

small batch kettles— another important *spi FIRST



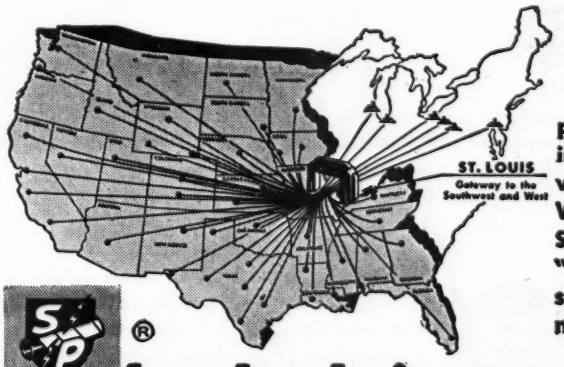
***standard pipeprotection inc.** designed and built a plant that was the first one equipped with small batch kettles to prevent alteration of the physical characteristics — softening point, penetration, and filler content — of the enamels, to assure performance of the enamels as formulated by the enamel manufacturers.*

① **FIRST** and only plant to melt 4-drum batches of enamels, one batch at a time, to prevent altering the physical characteristics. To secure a constant supply, a battery of kettles is fired in rotation, at short intervals, with reloading and refiring as emptied. A cycle from small cold lumps of enamel to complete consumption in less than three hours.

② **FIRST** plant to employ thermostatic temperature controls, with electric-eye flame controls and recording thermometers, to control the time and record the temperatures while melting the enamels to correct application temperature. These controls were the first used to prevent changes in physical characteristics of the enamels.

③ **FIRST** plant to provide mechanical cradle agitators for each kettle, to prevent sedimentation of enamel fillers added by the enamel manufacturers as a reinforcement for the bitumen.

The rotation firing of 4-drum batch kettles at Standard Pipeprotection Inc. prevents mixing different grades of enamels, and products of different manufacturers.



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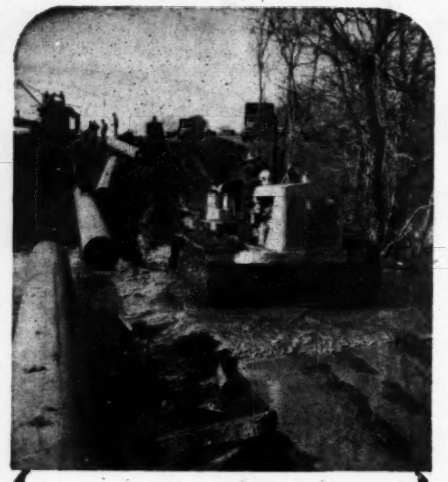

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Pipeline People

Guy T. Martin & Co. Inc. has appointed DAVID R. ARNOLD as engineer in charge of manufactured products. Mr. Arnold comes to the company from Superior Oil Co. where he was assistant superintendent of manufacturing and sales.

Former director and vice president in charge of exploration and research for Carter Oil Co., Tulsa, HAROLD F. MOSES, has been elected president of Interstate Natural Gas Co., Monroe, La. He succeeds GEORGE A. WILSON, who becomes chairman of the board. Mr. Moses was also made general manager of the new oil and gas division of Olin Industries Inc., controlling owner of Interstate.

Cooper-Bessemer Corp., Mount Vernon, has announced the appointment of R. L. MOORE as sales engineer in its Chicago office.

R. L. Moore
Cooper-Bessemer

E. C. Inghram
N. Y. State

EDWARD C. INGHRAM, general superintendent of New York State Natural Gas Corp., Pittsburgh, has been elected a director of the company.

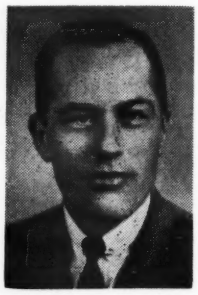
WILLIAM L. WHITCOMB has been appointed assistant to the director of advertising of Glass Fibers, Inc., Toledo. He was formerly advertising manager of Weis Manufacturing Co., Monroe, Mich.

C. D. Rogers

L. C. Benne
Cities Service

Promotion of three men in key positions has been announced by Cities Service Gas Co., Oklahoma City. Advancements include CLINT D. ROGERS from superintendent to manager of operations. He will move from Wichita to Oklahoma City. L. C. BENNE moves up from assistant superintendent to superintendent of operations in Wichita; and H. O. PORTER switches from assistant superintendent of gas transportation to fill that spot for operations.

H. F. TRUSLER JR. has been appointed east coast sales representative for the Protective Coatings Division of Pittsburgh (Pa.) Coke & Chemical Co. He will remain in the New York office. M. E. MADDOX has been transferred from the division's Tulsa office to the southeastern area as sales representative and will headquarter in Atlanta.



H. F. Trusler Jr.
Pittsburgh Coke

J. H. Caldwell
S. D. Day

JOHN H. CALDWELL, formerly a corrosion engineer for Glen Martin Aircraft, has joined the S. D. Day Co., Houston, as sales engineer working with cold coatings and their applications.

Former Boston Consolidated Gas Co. cadet engineer DOLNAD L. GARRISON has been appointed sales promotion representative for new gas pipeline products and corrosion products of Dresser Manufacturing Div.

D. L. Garrison
Dresser

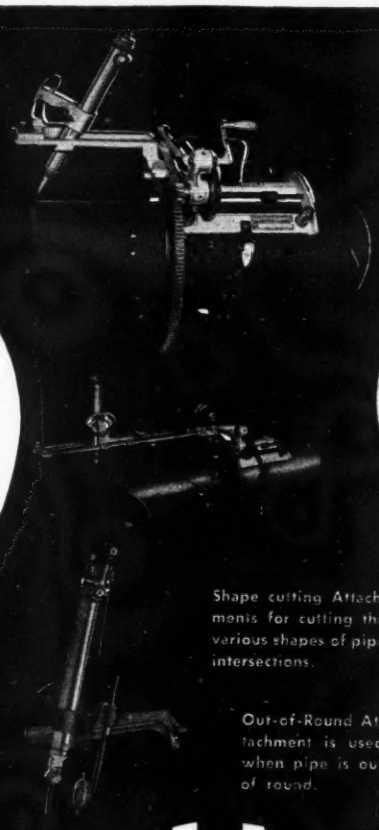
Don Turner
National Tank

DON TURNER recently resigned as executive vice president of Rinehart Oil News, Dallas, to join National Tank Co., Tulsa, as its general counsel and administrative assistant.

R. E. SHACKELFORD, 47, general manager of Perrault Equipment Co., Tulsa, died recently following a paralytic stroke. He served on the management team at Perrault for eight years.

H. R. BENNETT, 57, director of United Gas Pipe Line Co. and vice president and director of Union Producing Co., both of Shreveport, died suddenly of a heart attack August 19. He had been in the oil and gas business since 1921.

For Easier, Faster, Pipe Cutting & Beveling



Shape cutting Attachments for cutting the various shapes of pipe intersections.

Out-of-Round Attachment is used when pipe is out of round.

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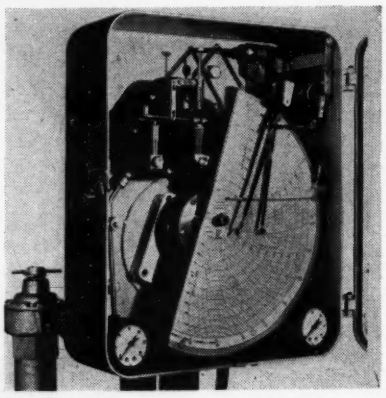


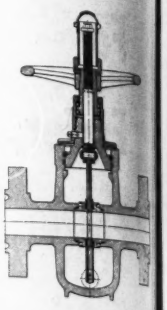
20 Differential Controller

A newly developed differential controller for changeover valves has been introduced by Rockwell Manufacturing Co. The new device has been designed for orifice meter measuring stations where a wide variation of flow conditions is encountered. The differential controller offers a means of automatically turning an additional measuring unit into the line when needed and shutting it off completely when not needed. This procedure makes it possible to obtain accurate measurement where there is considerable variation in flow.

Rockwell Manufacturing Co.

■

21 Gate Valve

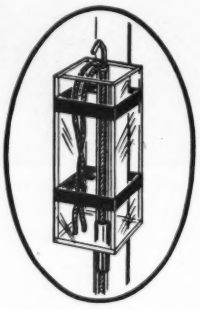


Especially suited for production and pipeline use, the new Grove Seal-O-Ring gate valve is a full-opening, conduit-type valve that provides an impassable seal that shuts off bubble-tight without resorting to such means as wedges, plugs, or other packing devices. A precision finished port-plate freely slides open and closed between floating, self-aligning dual-sealing rings.

Grove Regulator Co.

■

22 Instrument Ink Feed

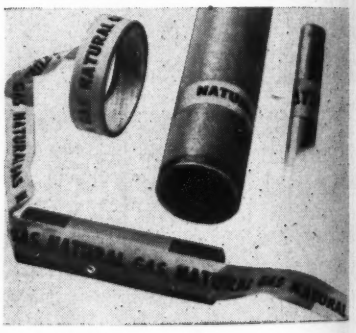


Simple in design is the new Squier Evertite instrument ink feed. Fabricated of light weight plastic, the ink feed is quickly attached with plastic bands to all makes of instrument pens. No special brackets or pen arm alterations are required.

Operating on the principle of capillary action, the ink feeds up, then down to point.

John P. Squier Co.

■



23 Vinyl Tape Labels

Printed Cellophane Tape Co. is processing a printed, pressure-sensitive Vinyl tape that is suitable for labeling gas pipe.

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- ◯ HAS YOUR COMPANY GIVEN ANY RECOGNITION TO DONORS?
- ◯ DO YOU HAVE A BLOOD DONOR HONOR ROLL IN YOUR COMPANY?
- ◯ HAVE YOU ARRANGED TO HAVE A BLOOD-MOBILE MAKE REGULAR VISITS?
- ◯ HAS YOUR MANAGEMENT ENDORSED THE LOCAL BLOOD DONOR PROGRAM?
- ◯ HAVE YOU INFORMED EMPLOYEES OF YOUR COMPANY'S PLAN OF CO-OPERATION?
- ◯ WAS THIS INFORMATION GIVEN THROUGH PLAN BULLETIN OR HOUSE MAGAZINE?
- ◯ HAVE YOU CONDUCTED A DONOR PLEDGE CAMPAIGN IN YOUR COMPANY?
- ◯ HAVE YOU SET UP A LIST OF VOLUNTEERS SO THAT EFFICIENT PLANS CAN BE MADE FOR SCHEDULING DONORS?

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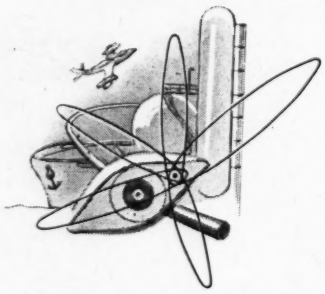

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Progress Reports

PLANNED

CAROLINA NATURAL GAS CORP., Charlotte, N. C. Docket G-1956 for 40 miles of line to connect with Transco line near Kings Mountain, N. C., extending to Rock Hill, S. C., with laterals to four South Carolina points.

CENTRAL KENTUCKY NATURAL GAS CO., Charleston. Docket G-2192 for 5 miles of 20-in. lateral extending from connection with Gulf Interstate in Menifee county, Ky. to its own Means, Ky. compressor station.

CENTRAL WEST UTILITY CO., Kansas City. Docket G-1682, four alternate plans to serve Clay county, Mo.

CHATTAHOOCHEE NATURAL GAS CO., Birmingham. Docket G-2066 for 70 miles of line in northwest Georgia, to connect with system of Southern Natural in Floyd county.

CITIES SERVICE GAS CO., Oklahoma City. Docket G-2149 for 69 miles of line—44 miles 20-in.; 25 miles 16-in.—and 1100-hp addition to Edmond compressor in Oklahoma county.

COLORADO INTERSTATE GAS CO., Colorado Springs. Docket G-2121 (1954 program) 365 miles of 22-in. line from Denver to connection with proposed Pacific Northwest Pipeline Corp. line at Green River, Wyo., with 5500-hp compressor station at Green River.

EAST OHIO GAS CO., Cleveland. A 125-mile, 26-in. pipeline to serve Cleveland area from point just south of Toledo.

KANSAS-NEBRASKA NATURAL GAS CO. INC., Phillipsburg, Kan. Docket G-2186 for 41 miles of line in Kansas and Nebraska, and a new compressor station from items salvaged from abandoned station.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh. Docket G-2193 for 72 miles of 20- and 16-inch line, 38.7 miles of storage and well lines, 2 measuring stations and a 1760-hp compressor station at the Victory storage field in Marshall and Wetzel counties, W. Va.

MISSOURI CENTRAL NATURAL GAS CO., Macon, Mo. Docket G-1509 for 25 miles of 6-in. from Moberly to Macon, Mo.

MISSOURI PUBLIC SERVICE CO., Warrensburg. Docket G-2057 for 109.3 miles of 8- and 10-in. mainline and 27.1 miles of lateral lines. System to connect with Panhandle Eastern Pipeline Co. line at Franklin, Mo. and extend northwest.

MORGANFIELD NATURAL GAS CO., Morganfield, Ky. Docket G-1935 for a 31-mile, 4- and 6-in. line lateral to proposed Texas Gas Transmission Corp. line, to serve 6 Kentucky towns.

NEW YORK STATE NATURAL GAS CORP., Pittsburgh. Docket G-1980 (in part) for a 75-mile, 20-in. line from southern end of Driftwood field line to main dual line in Armstrong county, Pa. Williams-Austin Co. completed 10 miles of this line; remainder not to be constructed at present.

NORTHERN INDIANA FUEL & LIGHT CO., Auburn. To build 35-mile line to supply gas to 12 Indiana communities. To connect with Panhandle Eastern near Edgerton to own system at Auburn.

NORTHERN NATURAL GAS CO., Omaha. Docket G-1918 for 400 miles of 24-in. pipe from the United States-Canadian border to a point near Minneapolis and two compressor stations with 5280 hp each.

NORTHERN NATURAL GAS CO., Omaha. Docket G-2063 (in part-second year program) for 204 miles of 24-, 26- and 30-in. mainline additions to connect with Permian Basin Pipe Line Co. system, and 22,800 hp in new and existing stations in Texas, Oklahoma, Kansas, Nebraska, Iowa, Minnesota and South Dakota.

NORTHWEST NATURAL GAS CO., New York. Docket G-996 for 992 miles of 18-, 20-, 22-,

and 24-in. line in Washington, Idaho, Oregon and British Columbia, together with laterals and four compressor stations aggregating 30,800 hp.

OHIO FUEL GAS CO., Columbus. Docket G-2194 for 69 miles of 20- and 24-in. lines and 3000-hp addition to Crawford compressor station.

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket No. 2212 for 11 miles of 24-in. line to serve steam electric plant near Pittsburg.

PACIFIC NORTHWEST PIPELINE CORP., Houston. Docket G-1429 for 1466 miles mainline; 380 miles of spur and lateral lines; and 16 compressor stations totaling 104,420 hp, to extend from Ignacio, Colo., in the San Juan basin, to Bellingham, Wash. (Seattle area).

SHENANDOAH GAS CO., Lynchburg, Va. Docket G-1448 for 39 miles of line from a point near Middletown, Va. to points near Winchester, Va. and Martinsburg, W. Va.

SOUTHERN NATURAL GAS CO., Birmingham. Docket G-2065 for line tap and metering and regulating facilities to supply Chattahoochee Natural Gas Co. Docket G-2208 for 2 miles of 12¾-in. loop along Macon lateral.

TEXAS EASTERN TRANSMISSION CORP., Shreveport. Docket G-2208 for 17 miles of 6 and 8-in. lines to connect with Englehart and Big Hill gas fields; a 4400-hp compressor station in Shelby county, Texas.

TRANS-CANADA PIPE LINES LTD., for 2200-miles 30-in. line from Alberta to Toronto; 24-in. line from Toronto to Montreal with 14-in. line to Ottawa; 747-mile gathering system and 13 compressor stations totaling 94,160 hp.

TRANS-NORTHWEST GAS INC., Spokane. Docket G-2111 for construction of a 521-mile system to serve markets in eastern Washington and northern Idaho, starting at international border near Osoyoos, B. C., south to Hanford, Wash., east to Spokane and Wallace, Idaho, north again from Spokane area to Trail, B. C.

UNITED FUEL GAS CO., Charleston. Docket G-2192 for 88 miles of 30- and 20-in. line connecting a new 6000-hp compressor station to its own lines in W. Va., and that of Gulf Interstate in Boyd county, Ky.

WESTCOAST TRANSMISSION CO. INC., Wilmington, Del., 396 miles, including 270 miles from Sumas, Wash. to Portland, Ore. with short branches to a number of cities in the two states, and 126 miles of laterals and 26 measuring stations. To connect with 662-mile, 24-in. line to be built by parent company, Westcoast Transmission Co. Ltd., from Peace river area of Alberta and British Columbia. Survey under way.

UNDER WAY

ALGONQUIN GAS TRANSMISSION CO., Boston. Facilities including several laterals remain to be completed. FPC has approved completion. Contractors are Perna Bros., Associated Pipe Line Contractors, Consolidated Gas & Service, and Fulghum Contracting Corp. Completion expected Oct. 15.

CHICAGO DISTRICT PIPELINE CO., Joliet, Ill. Docket G-2090 for 3.4 miles of 36-in., 15.7 miles of 30-in. and a .2-mile river crossing of 24-in. pipe in the Chicago area. Expect completion Dec. 1.

CITIES SERVICE GAS CO., Oklahoma City. Docket G-2038 for installation of 11,400-hp compressor capacity—three 1600-hp units to be added to its Greenburg station, Kiowa county; six 1100-hp units in a new station in Harvey county, Kan. Expected to be complete Oct. 15, 1953.

EL PASO NATURAL GAS CO. Work in progress on plant construction for 153,000 hp in mainline and booster compressor stations. Work done by company's own crews; expected to be complete at all stations by December 1953.

GULF INTERSTATE GAS CO., Houston. Docket G-2058 to construct 860 miles of 30-in. line from Rayne, La. to Boyd county, Ky., 229 miles lateral lines and five 8000-hp compressor stations in four states. Mainline contracts let to H. C. Price and Houston Contracting Co. Lateral line contracts let to Anderson Bros., Associated Pipe Line Contractors and Williams Bros. Parkhill Truck Co. hauling pipe. Expect completion Nov. 1, 1954.

LONE STAR GAS CO., Dallas. A 73-mile gathering and transmission system in Jack and Wise counties with a 3320-hp compressor station—the Jacksboro. Line completed in September. Compressor station to be operating early this month.

LONE STAR GAS CO., Dallas. At work on 44-mile, 12-in. line from Red Springs field north of Tyler to connection with company line in Hopkins county; a 36-mile, 12-in. line from Stamford to Abilene.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh. To construct 10 miles of line from Benezette gas field in Elk county to New Castle, Pa. area. Work begun in September. Williams-Austin Co. at work on 10 miles of 12-in. and 16-in. in Driftwood, and 12 miles of 12-in. in Washington county, Pa.

NEVADA NATURAL GAS PIPE LINE CO., Las Vegas. Docket G-1888 for 110 miles of 10-in. line from Topock, Ariz. to Whitney, Nev., serving Las Vegas and Henderson areas. Contract let to R. H. Fulton Co., Lubbock, Texas. Gas to flow Dec. 20. Pipe delivery begun Oct. 1.

NEW YORK STATE ELECTRIC & GAS CORP., Ithaca. Docket G-1999 for total of 49 miles of pipeline; 25 miles 10-in. from DeRuyther to Norwich, N. Y., 24 miles 8-in. from Norwich to Oneonta, N. Y. Rich & Co. at work. Completion expected Nov. 15.

NEW YORK STATE NATURAL GAS CORP., Pittsburgh. Docket G-1824; Williams-Austin Co. to construct 10.8 miles of 20-in. line from Craigs Corners to Caledonia, N. Y. Work started Sept. 1.

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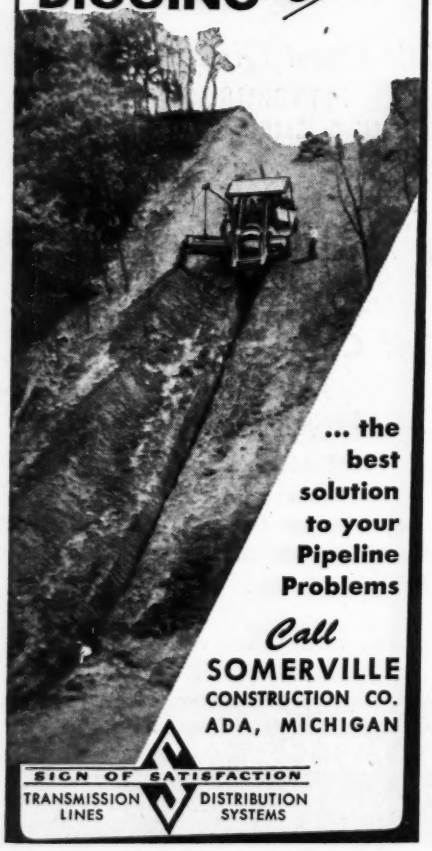

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Barber-Greene Canada Ltd. will manufacture belt conveyors at this new factory and general office near Toronto, Ontario, which was dedicated Aug. 26. Expansion into other equipment manufactured by the parent company, Barber-Greene Co., Aurora, Ill., is contemplated for the future. The 30,000-sq ft building is located on a 16-acre plant site which provides ample room for future expansion.

NORTHERN NATURAL GAS CO., Omaha. Docket G-1618 for 213 miles of 26-in. loop lines in Texas, Oklahoma, Iowa, Kansas, Nebraska and Minnesota, and 100,160-hp additional compressor capacity. G. G. Griffis Inc. and R. H. Fulton Co. at work on lines; Walco Engrg. Co., Engineers Ltd. /Pipeline Co., H. B. Zachry Co. and Dresser Engrg. Co. on compressors. Completion expected this month.

NORTHERN NATURAL GAS CO., Omaha. Docket G-2063 (in part—first year program) for 259 miles of 24- and 30-in. pipe and 50,400 hp in compressor capacity in new and existing stations in Texas, Oklahoma, Kansas, Nebraska and Iowa. Also 475 miles of branch lines and additions to serve Iowa, Minnesota, Nebraska and South Dakota. G. G. Griffis Inc., R. H. Fulton & Co. and Lone Star Constructors at work on mainline. Compressor work being done by Dresser Engrg. Co., Foor Engrg. Co., H. B. Zachry Co. and Engineers Ltd. Pipeline Co. Completion expected in December.

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket G-1892 for 15 miles of 20-in. pipe extending from Helm and joining the system's Topock-Milpitas line in Fresno county; and for 15.5 miles of 12¾-in. in Madera county parallel to the existing Madera-Livingston line. Alex Robertson Co. expected to complete work this month.

PERMIAN BASIN PIPELINE CO., Omaha. Docket G-1928 for 234 miles of line and 54,880 hp in compressor stations to carry gas from Upton, Midland, and Pecos counties, Texas and Lea county, N. M. to connection with 24-in. El Paso Natural line to Dumas, Texas. R. H. Fulton at work on mainline. Fluor Corp. Ltd., Dresser Engrg. Co. and Sterns-Roger Mfg. Co. on compressors. Completion expected in December.

SOUTH ATLANTIC GAS CO., Savannah. Latex Construction Co. at work on system to connect with Southern Natural Gas line.

SOUTHERN COUNTIES GAS CO., Los Angeles. Alex Robertson Co. at work on 12-mile, 16-in. line from San Luis Obispo to Arroyo Grande; 2- mile, 10-in. line from San Luis Obispo to connection with Paso Robles line.

SOUTHERN COUNTIES GAS CO., Los Angeles. Docket G-2182 for 14 miles of 24- and 22-in. pipe from connection with Blythe-Santa Fe Springs line near Brea to Santa Ana. Hood Construction at work. Completion expected Nov. 15.

SOUTHERN NATURAL GAS CO., Birmingham. Docket G-1907. Total project approved including 792 miles of line and 18,500-hp compressor capacity—about 522 miles of looping on existing system. About 250 miles various size line remaining for construction in 1954. 180 miles of looping, addition of 5400 hp to existing stations, about 270 miles in new lines and 3 new compressor stations, miscellaneous sized lines for gathering system, 384 mile line south of Gwinville, Miss.; a 5400-hp compressor at Gwinville; new 5400-hp station at Ellerslie, Ga.; 4400-hp station at Macon, Ga.; and 3300-hp station at Toca, La. To be completed Nov. 15 by Brown & Root Inc., H. C. Price Co., Houston Contracting Co. and Latex Construction Co.

TEXAS ILLINOIS NATURAL GAS PIPELINE CO., Chicago. Docket G-1914 for six new compressor stations totaling 70,000 hp on its Texas to Illinois transmission line and installation of additional units totaling 10,000 hp at five existing stations. Also for construction of a suspension bridge across the Mississippi river and lateral lines to connect additional gas reserves to system. Contracts have been let for compressor work. Completion date, Dec. 1.

UTAH NATURAL GAS CO., Salt Lake City. To build a 62.8-mile 18-in. pipe from fields in Carbon, Emery and Sanpete counties running northwest to a point near Provo. R. H. Fulton & Co. is the contractor. This line expected to be in operation this month.

CONTRACTS LET

COLORADO INTERSTATE GAS CO., Colorado Springs. Docket G-2120 (1953 program) 49 miles of 20-in. loop line on line near Denver; 30 miles of 12-in. to connect 20-in. with Morton county, Kan. compressor station; 24,860 hp compressor capacity at new and existing stations in Colorado, Oklahoma, Texas, and Kansas. Engineering Construction Co. at work in Kansas. Contracts let to R. H. Fulton & Co. for lines, Fish Engineering Co. and Sterns-Roger on stations. All under way.

EAST TENNESSEE NATURAL GAS CO., Knoxville. Docket G-1336 for a 100-mile, 16-in. line from near Knoxville to Kingsport, Tenn. with about 58 miles of various sized lateral lines. Contract let to Engineering Construction Co. for 3½ mile Harriman (Tenn.) lateral, and 94 miles of 16-in. line from Topside to Kingsport. Work started Aug. 5, expect completion Jan. 1, 1954.

EL PASO NATURAL GAS CO. Docket G-2106 for total of 1056 miles of line to include about 750 miles of 30-in. and 70 miles of 24-in. mainline with related gathering lines, purification facilities and compressor plants totaling 161,860 hp to carry gas from Permian and San Juan basins. Contractors are Oklahoma Construction Co., R. H. Fulton Co. and company's own crews. Part of facilities scheduled to be in operation by January 1954, remainder by November 1954.

IOWA-ILLINOIS GAS & ELECTRIC CO., Davenport. Gabe's Construction Co. at work on 28 miles of 10-in. line from Iowa City to Cedar Rapids. Expect completion Nov. 1.

MICHIGAN CONSOLIDATED GAS CO., Detroit. To construct 35 miles of 6- to 24-in. line to Six Lakes gas storage field. Somerville Construction Co. began work in September; completion expected Dec. 1.